DIAGNOSTIC YIELD OF NEUROIMAGING IN OCULAR MOTOR CRANIAL NERVE PALSIES

DISSERTATION SUBMITED FOR

MS (Branch III) Ophthalmology

THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY

CHENNAI

APRIL – 2016

CERTIFICATE

This to certify that this dissertation entitled **"DIAGNOSTIC YIELD OF NEUROIMAGING IN OCULAR MOTOR CRANIAL NERVE PALSIES"** is a bonafide work done by **Dr.S.Kanimozhi** under our guidance and supervision in the Neuroophthalmology department of Aravind Eye Hospital and Post Graduate Institute of Ophthalmology, Madurai during the period of her post graduate training in Ophthalmology for May 2013-April 2016.

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DECLARATION

I, Dr.S.Kanimozhi hereby declare that this dissertation entitled, **‘‘DIAGNOSTIC YIELD OF NEUROIMAGING IN OCULAR MOTOR CRANIAL NERVE PALSIES”,** is being submitted in partial fulfilment for the award of M.S. in Ophthalmology Degree by the Tamilnadu Dr.MGR Medical university in the examination to be held in April 2016.

I declare that this dissertation is my original work and has not formed the basis for the award of any other degree or diploma awarded to me previously.

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I am privileged to have on my side **Dr.P.Namperumalsamy**, Chairman emeritus and Director of Research**, Dr.G.Natchiar**, Director emeritus, **Dr.M.Srinivasan** director emeritus and other scholars at Aravind eye care system who had been a great source of inspiration to us.

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PART –I

PART –II

INTRODUCTION

Ocular motor cranial nerve palsies are commonly encountered condition in many ophthalmic centres. The third, fourth and sixth cranial nerves coordinate in eye movements. Sixth cranial nerve is the most frequently affected out of the three[1]. Although the most common cause for such nerve palsies is due to microvascular ischaemia, other causes include trauma[1], vascular diseases, intracranial tumours, aneurysm and so on..

Now a days, cranial nerve palsies constitute the most common indications for imaging in Neuroophthalmology. Computed tomography angiography and magnetic resonance angiography are mandatory in the evaluation of arterial and venous disorders[2]. Neuroimaging like CT and MRI are ordered in neuroophthalmic practice, although the diagnostic yield of these tests have not been studied in detail in ocular motor cranial nerve palsies.

In the era faught with increasing malpractice issues, concerns have been raised about indications of imaging, which may do little to alter diagnosis and management. As medical technology progresses in the setting of limited resources, physicians are facing the dilemma of choosing a diagnostic test that is high yielding and cost effective. There has been

several attempts regarding framing guidelines about the appropriate time and necessity for imaging, the recommendations have differed..

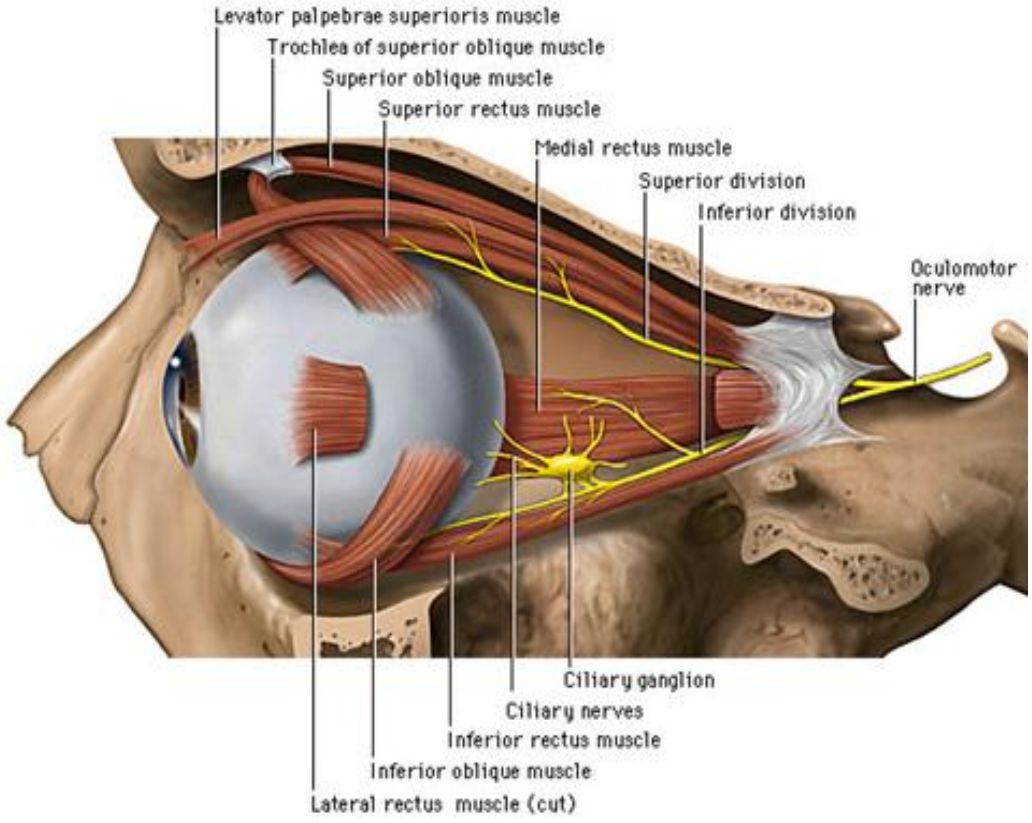
We framed this study to evaluate the diagnostic yield of neuroimaging in ocular motor cranial nerve palsies at our institute. To the best of our knowledge, only 4 reports are available to investigate the diagnostic yield of imaging in ocular motor cranial nerve palsies as a whole in India.

OCULAR MOTOR CRANIAL NERVES

The extraocular muscles are supplied by the oculomotor, trochlear and abducent nerves.

OCULOMOTOR NERVE:

It is the largest of the ocular motor nerves[2,3] which is entirely motor in function. It supplies levator palpebrae superioris and all extraocular muscles of eye except superior oblique and lateral rectus. Also innervates sphincter pupillae and ciliary muscle.



COURSE OF OCULOMOTOR NERVE

FUNCTIONAL COMPONENTS[3]:

SOMATIC EFFERENT:

Concerned with movements of eyeball. Motor supply to levator palpebrae superioris, superior rectus, medial rectus, inferior rectus and inferior oblique.

GENERAL SOMATIC AFFERENT:

Proprioceptive impulses from these muscles.

GENERAL VISCERAL EFFERENT:

Parasympathetic component-motor supply to sphincter pupillae and ciliaris.

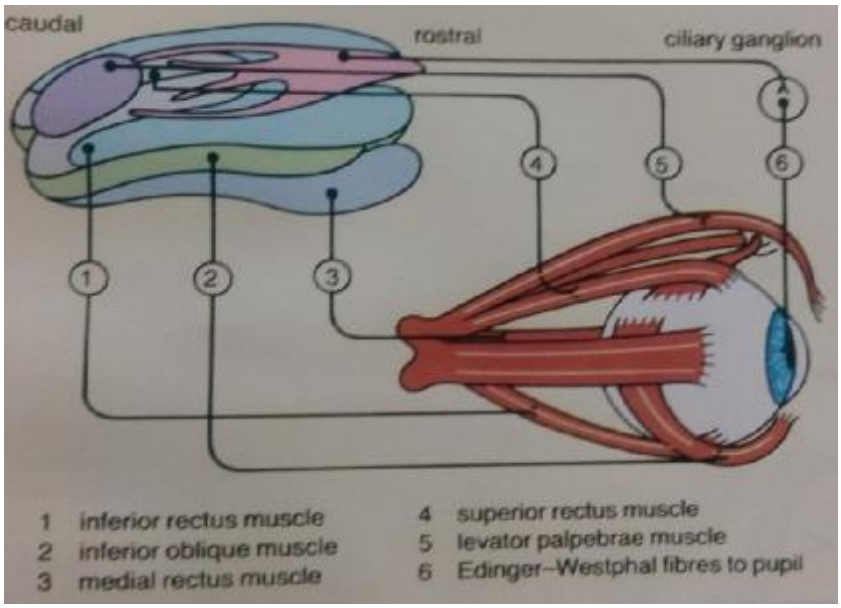
OCULOMOTOR NUCLEAR COMPLEX[1]:

Situated at the level of superior colliculus, in the ventromedial part of central grey matter that surrounds the cerebral aqueduct in the midbrain. It is a longitudinal column of about 10mm in length. It is located in the inferior periaqueductal gray matter of the mesencephalon. Superiorly it approaches the floor of 3rd ventricle, inferiorly it is continuous with the trochlear nerve nucleus.

OCULOMOTOR NERVE NUCLEI:

Includes two motor nuclei:

MAIN MOTOR NUCLEUS:



SITE:

Ventral part of grey matter surrounding the cerebral aqueduct of midbrain at the level of superior colliculus [1,2].

SUPPLY:

All extraocular muscles of the eye except superior oblique and lateral rectus. Levator palpebrae superioris of two sides are supplied by single central group of cells “central caudal nucleus”. The superior rectus muscle is supplied by contralateral oculomotor nucleus. The rest of the muscles are innervated by ipsilateral third nerve nucleus.

It is composed of subnuclei supplying individual extraocular muscles as follows:

WARWICK'S CLASSIFICATION

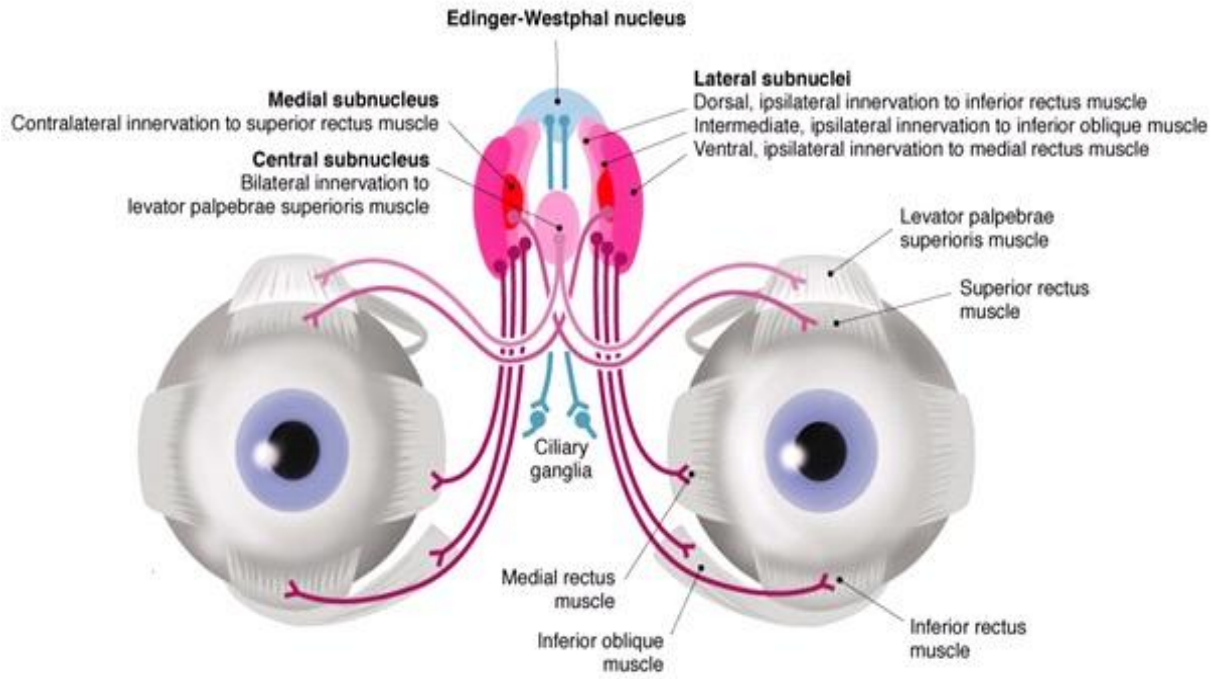
1.Dorsolateral nucleus: ipsilateral inferior rectus

2.Intermediate nucleus: ipsilateral inferior oblique

3.Ventromedial nucleus: ipsilateral medial rectus

4.Paramedian(scattered): contralateral superior rectus

5.Caudal central nucleus: bilateral levator palpebrae superioris



ACCESSORY PARASYMPATHETIC EDINGER WESTPHAL NUCLEUS:

SITE:

Lies dorsal to the main motor nucleus.

SUPPLY:

The axons, which are preganglionic accompany other oculomotor fibres to relay within ciliary ganglion in orbit and supply sphincter pupillae & ciliary muscles via short ciliary nerves. It consists of a median and two lateral components. Perhaps, the cranial half of the nucleus is concerned with light reflexes and the caudal half with accommodation. The median part is fork shaped (nucleus of Pelia) and its role in convergence is questionable.

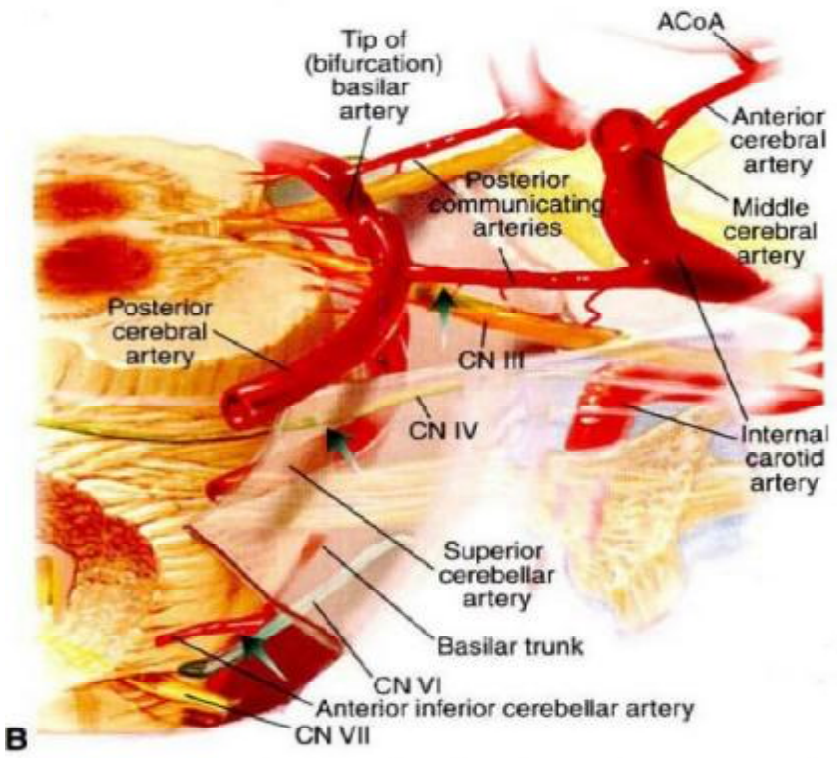
CONNECTIONS[2]:

1. Cerebral cortex
    a. Motor cortex(precentral gyrus) of both sides through corticonuclear tracts.
    b. Visual cortex through the superior colliculus and tactobulbar tract.
    c. Frontal eye field.

2. Nuclei of 4th,6thand 8th cranial nerves through the medial longitudinal bundle.
3. Pretectal nucleus of both sides.
4. Vertical and torsional gaze centres through the medial longitudinal bundle.
5. Cerebellum through the vestibular nuclei.

COURSE AND DISTRIBUTION:

FASCICULAR:

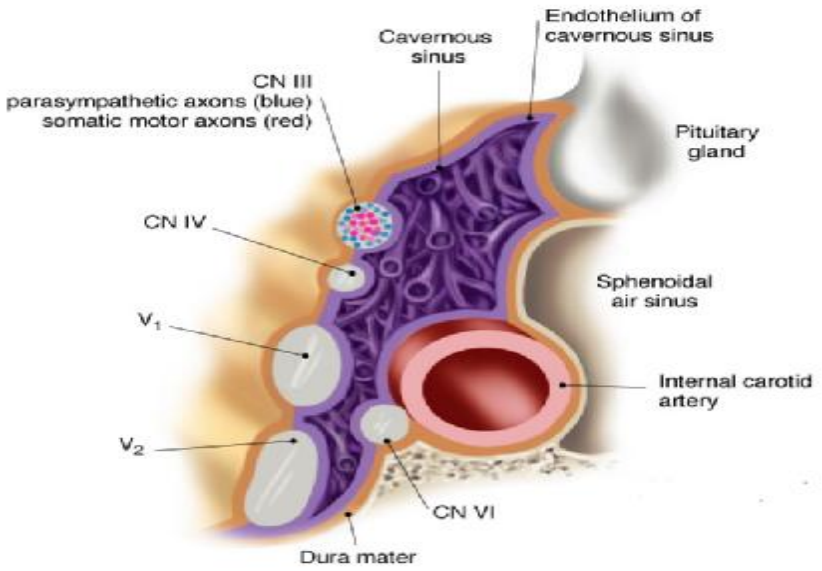


Fasciculus consists of efferent fibres which pass from the third nerve nucleus through the red nucleus and the medial aspect of cerebral peduncle. They emerge from the midbrain and pass into the interpeduncular space [1,2].

BASILAR PART:

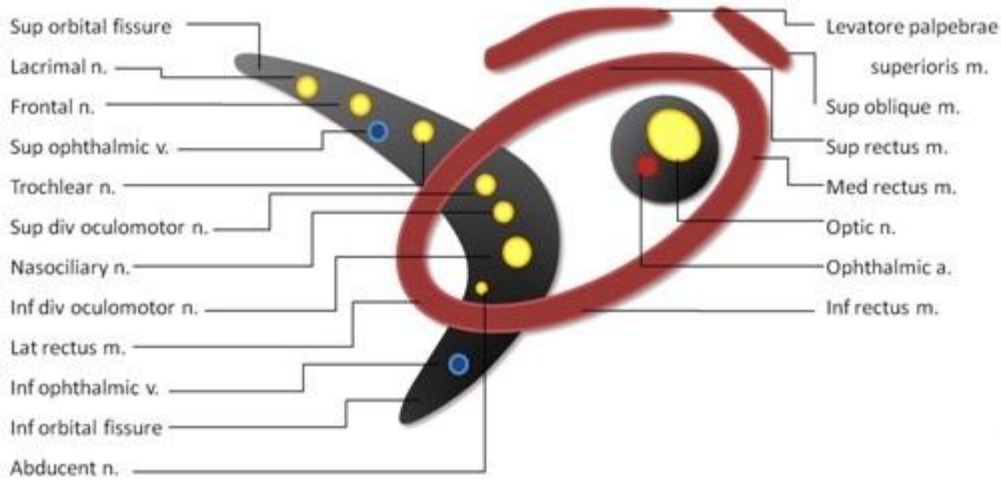
Starts as a series of 15-20 rootlets in the interpeduncular fossa. The nerve passes between the posterior cerebral artery and superior cerebellar artery and runs forward in the interpeduncular cistern to reach the cavernous sinus.

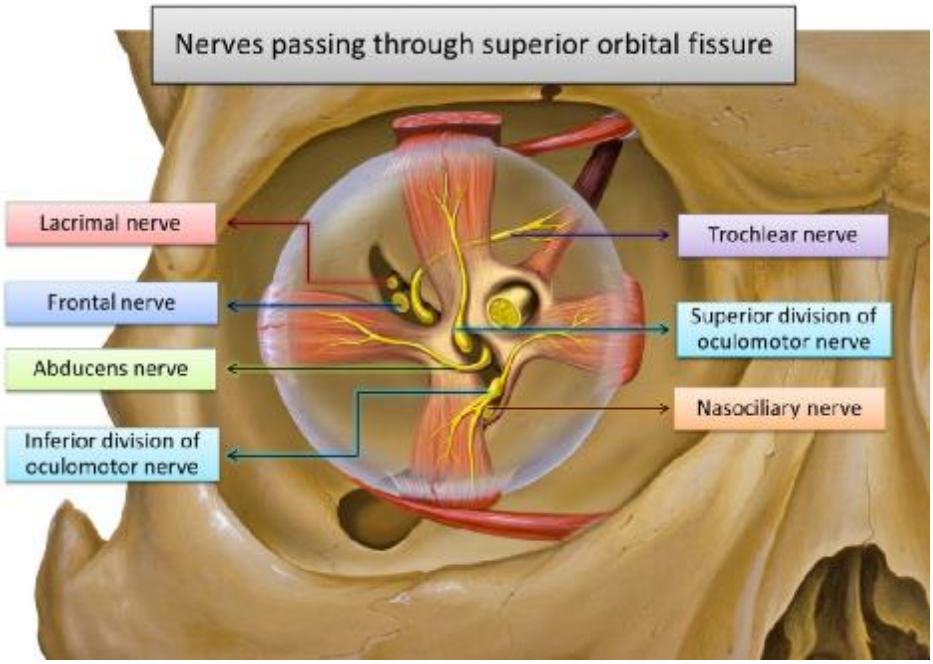
INTRACAVERNOUS PART:



Enters the cavernous sinus by piercing the posterior part of its roof on the lateral side of the posterior clinoid process. Then descends to the lateral wall of the sinus, where it lies above the trochlear nerve. In the anterior part

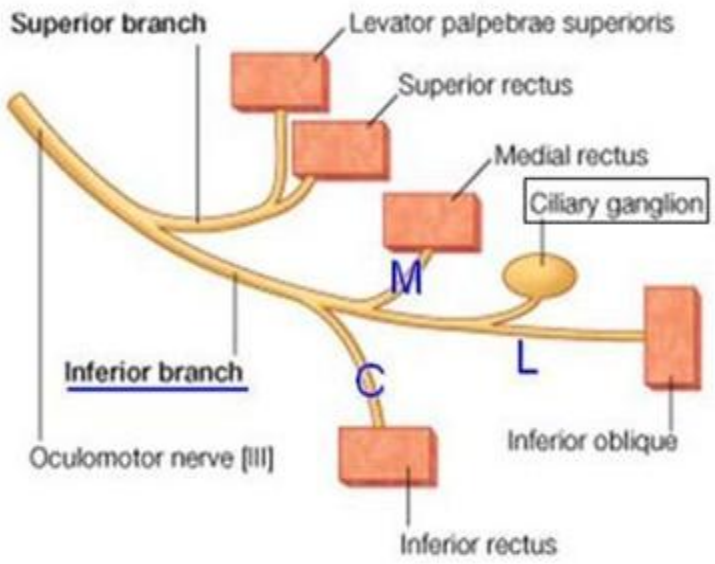
of cavernous sinus, it divides into superior and inferior divisions which enter the orbit within the annulus of Zinn through the middle part of superior orbital fissure.





INTRAORBITAL PART:

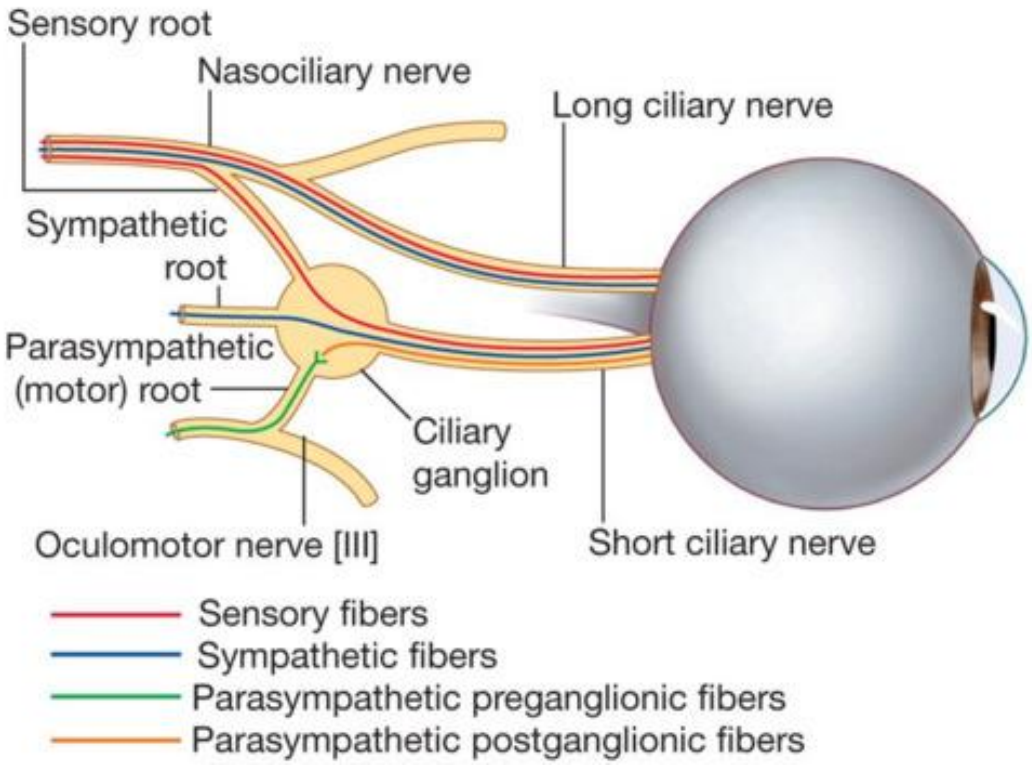
The smaller superior division ascends on the lateral side of optic nerve and supplies superior rectus and levator palpebrae superioris.



The larger inferior division divides into three branches[1];

1. Nerve to medial rectus passes inferior to the optic nerve.
2. Nerve to inferior rectus passes downward and enters the muscle on its upper aspect.
3. Nerve to inferior oblique passes in between inferior rectus and lateral rectus and supplies the inferior oblique. It supplies the motor root to the ciliary ganglion.

CILIARY GANGLION[2]:



It is a peripheral parasympathetic ganglion situated near orbital apex between optic nerve and lateral rectus, lying usually on lateral aspect of ophthalmic artery. Receives three roots posteriorly.

Parasympathetic root (motor) :

It is a branch from the nerve to inferior oblique, carrying pre-ganglionic fibres from the Edinger Westphal nucleus. Fibres are relayed in the ganglion and postganglionic fibres travel in the short ciliary nerves.

Sympathetic root:

It is a branch from internal carotid plexus and it enters the orbit via the superior orbital fissure. It consists of postganglionic fibres from superior cervical sympathetic ganglion which traverse the ciliary ganglion without relay to emerge through short ciliary nerves.

Sensory root:

Contains sensory fibres from the eyeball, which reach the ganglia via short ciliary nerves and pass through it. It leaves the ganglion backwards to join nasociliary nerve near the point where that nerve enters the orbit.

BRANCHES:

These are the short ciliary nerves, 8-10 delicate filaments which emerge from the ganglion. They run forwards in wavy course in company with short ciliary arteries, above and below the optic nerve. They subdivide into 15-20 branches which pierce sclera around optic nerve and pass forwards in delicate grooves on inner surface of sclera.

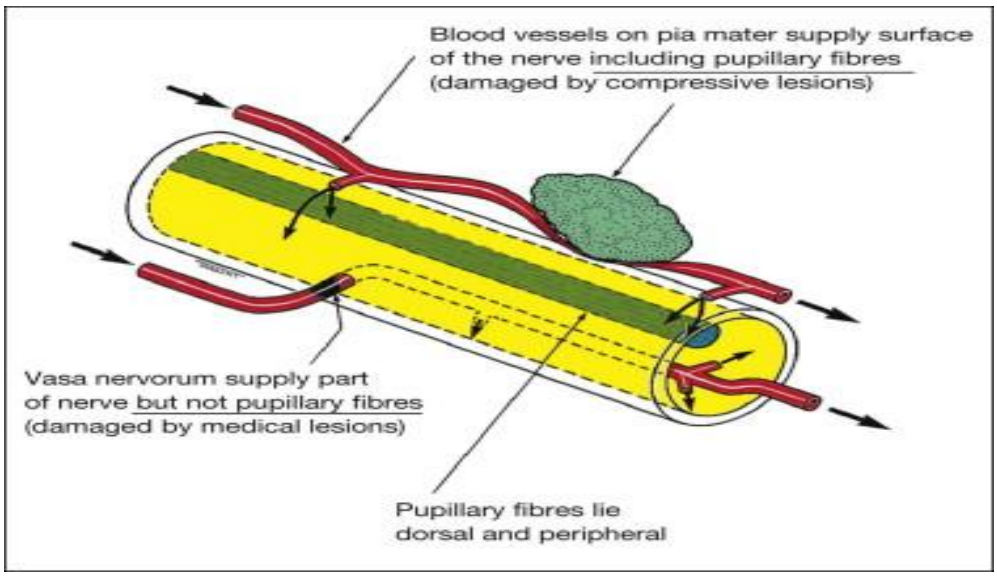
BLOOD SUPPLY:

Blood supply to the medial aspect of brainstem is from vessels directly off the basilar artery[1]. The fascicular portion of oculomotor nerve is supplied by the small perforators of circumflex arteries. In subarachnoid

space it is via vascular twigs from the posterior cerebral artery, the superior cerebellar artery, and tentorial and dorsal meningeal branches of meningohypophyseal trunk of internal carotid artery. These branches along with branches from ophthalmic artery supplies third nerve in the region of cavernous sinus.

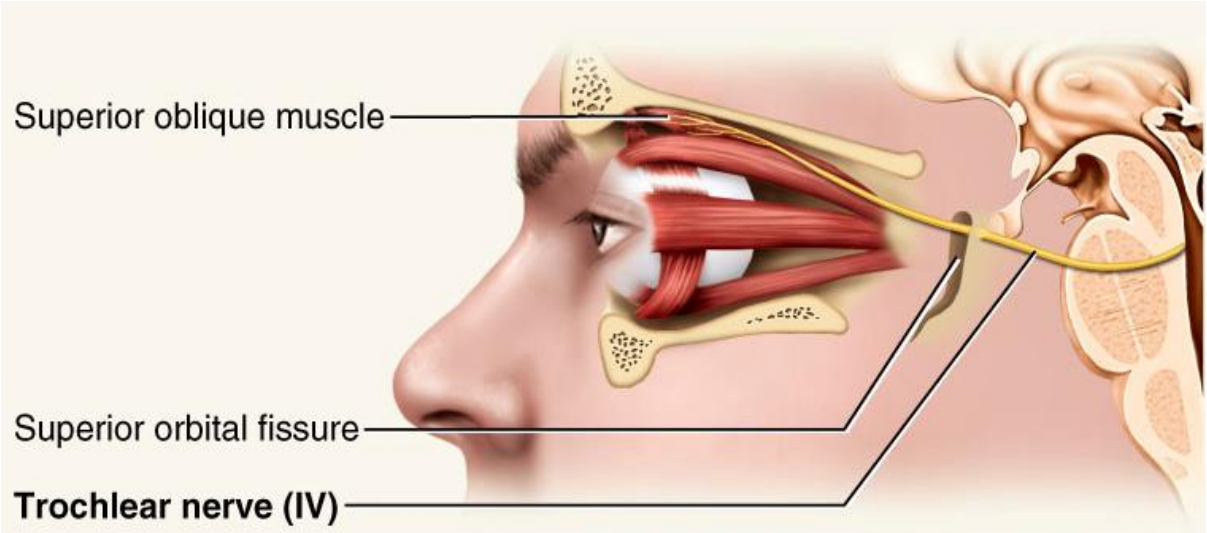
LOCATION OF PUPILLOMOTOR FIBRES:

In the part of oculomotor nerve which lies between brainstem and cavernous sinus, the pupillomotor parasympathetic fibres are arranged superficially and superomedially.



Blood supply to the pupillomotor fibres is through the pial plexus, and vasa nervosum supplies the main trunk. It is obvious that deprivation of this blood supply by spasm, thrombosis or embolism may produce paralysis or paresis of the muscles supplied.

TROCHLEAR NERVE:



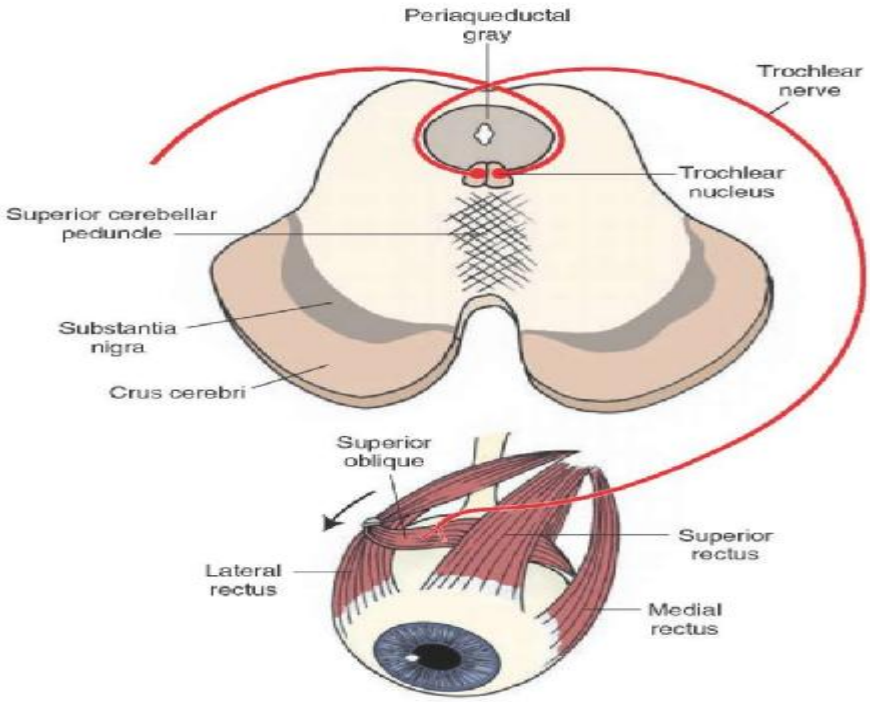
The nerve is named for the trochlea , the fibrous pulley through which the tendon of superior oblique passes. It is purely motor in function and supplies superior oblique muscle. It is crossed, most slender and has the longest intracranial course (7.5 cm). It emerges from the dorsal aspect of brain.

FUNCTIONAL COMPONENTS[2]:

1. Somatic efferent- concerned with movements of eyeball.
2. General somatic afferent- carries proprioceptive impulses from superior oblique muscle to mesencephalic nucleus of trigeminal nerve.

TROCHLEAR NUCLEUS:

It lies in the dorsum tegmentum of midbrain, ventrolateral to cerebral aqueduct at the level of superior border of inferior colliculus. It lies dorsal to medial longitudinal fasciculus and continuous with third nerve nucleus superiorly.



CONNECTIONS[2]:

1. Cerebral cortex
    - Motor cortex (precentral gyrus) of both sides through the corticonuclear tracts.
    - Visual cortex and the tectobulbar tract.
    - Frontal eye field.

2. Nuclei of 3rd, 6th and 8th cranial nerves through the medial longitudinal bundle.
3. Superior colliculi through the descending predorsal bundle
4. Vertical and torsional gaze centres.
5. Cerebellum through the vestibular nuclei.

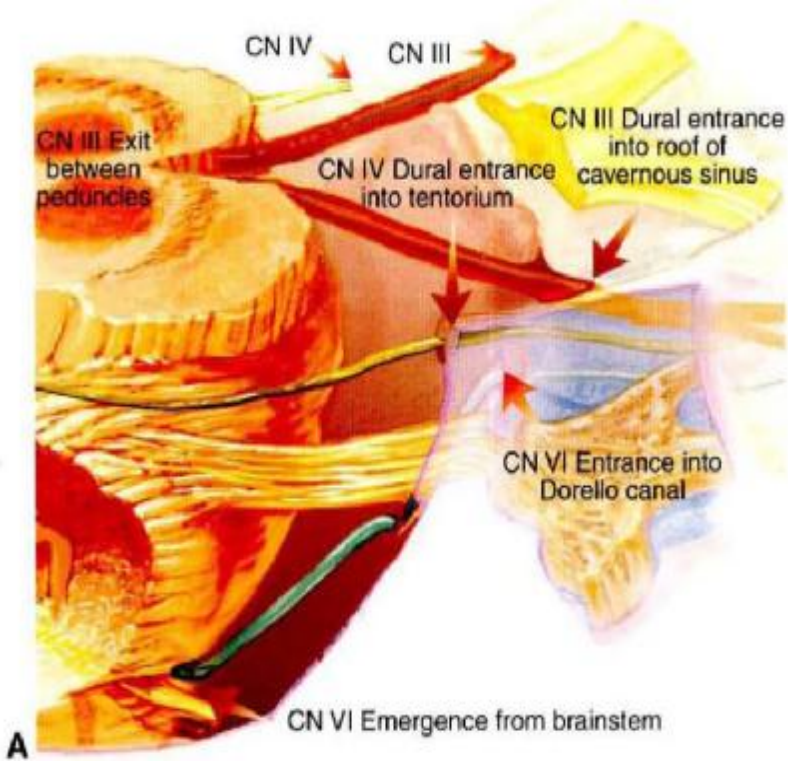
COURSE AND RELATION:

FASCICULAR PART:

From each nucleus, nerve fibres first run laterally to mesencephalic nucleus of fifth nerve, then downwards and parallel to aqueduct. At the lower border of inferior colliculus, they turn medially to decussate in superior medullary velum. Hence each superior oblique is supplied from contralateral trochlear nucleus.

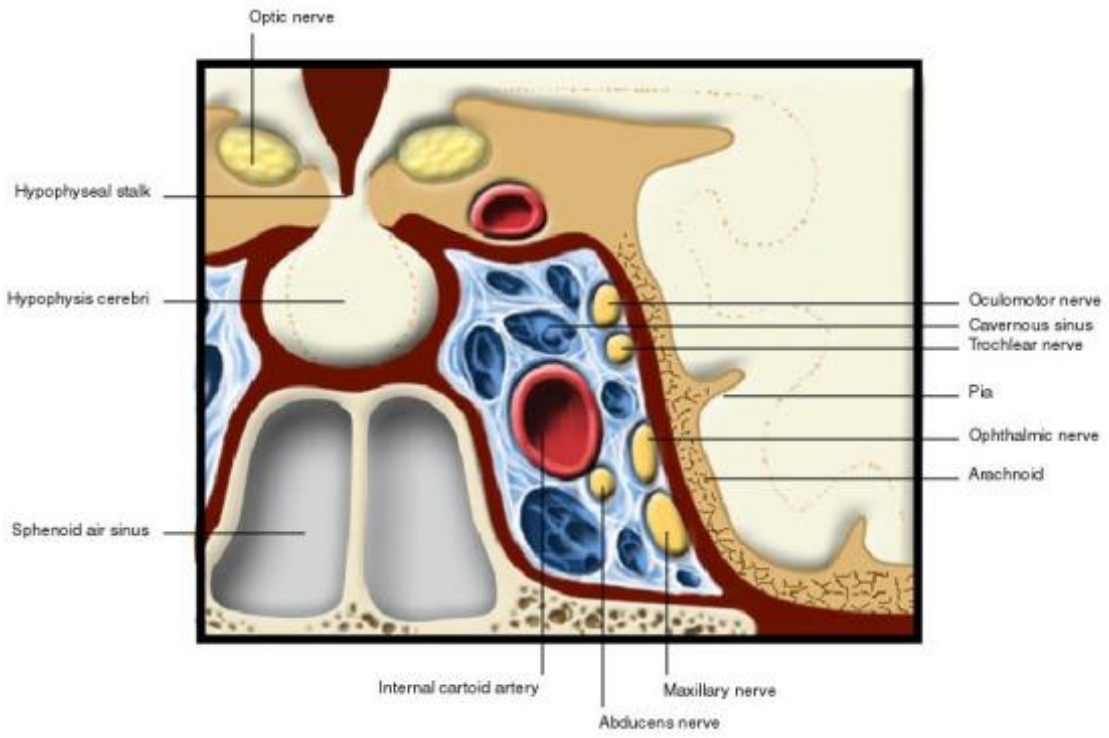
PRE-CAVERNOUS PART:

After crossing in superior medullary velum, the nerve emerge on dorsal aspect of superior cerebellar peduncle, then curves around the peduncle at the upper border of pons. During this course, the nerve is inferomedial to free margins of tentorium.



INTRACAVERNOUS PART:

The nerve reaches the cavernous sinus on the posterior part of its roof and goes to the lateral wall where it is superomedial to 1 st and 2nd division of trigeminal nerve, abducent nerve and internal carotid artery. While passing through the sinus, oculomotor nerve is first superomedial to trochlear nerve, then trochlear nerve cross over and becomes medial to it at the entry in superior orbital fissure.

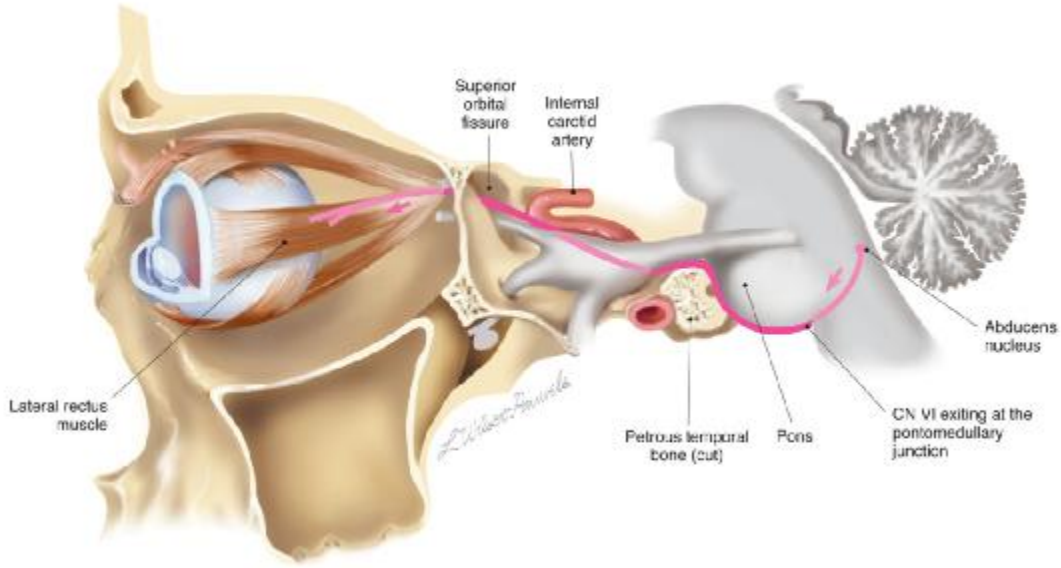


Trochlear nerve run in the upper region of fissure above the annular tendon where frontal and lacrimal nerves are superolateral to it.

INTRAORBITAL PART:

The nerve enters the orbit and fans out into 3-4 branches to supply superior oblique muscle on its superior surface. The number of fibres in intraorbital part of trochlear nerve are greater than its intracranial part. These extrafibres carrying the proprioceptive impulses from the superior oblique muscle, leave the trochlear nerve to join the ophthalmic division of 5^{th}nerve in the cavernous sinus. Ultimately these fibres relay in mesencephalic nucleus of 5^{th} nerve.

ABDUCENT NERVE:



Abducent nerve is entirely motor in function[1] and it supplies the lateral rectus muscle.

FUNCTIONAL COMPONENTS[2]:

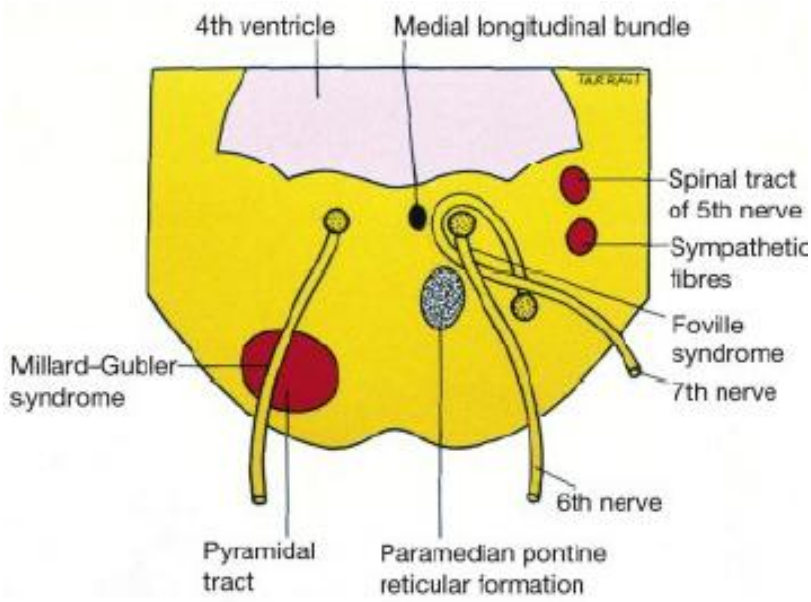
1. Somatic efferent:

For lateral movement of eye.

2. General somatic afferent:

For proprioceptive impulses from lateral rectus muscle.

ABDUCENT NUCLEUS:



It is a small mass of large multipolar cells, situated in the lower part of pons, beneath the floor of fourth ventricle, ventral to colliculus fascialis. The fasciculus of 7th nerve curves around the abducent nucleus. Numerous small multipolar cells intermingled with these large cells which form so called nucleus para-abducens. Fibres from these cells relay in the oculomotor nucleus via medial longitudinal fasciculus.

CONNECTIONS[2]:

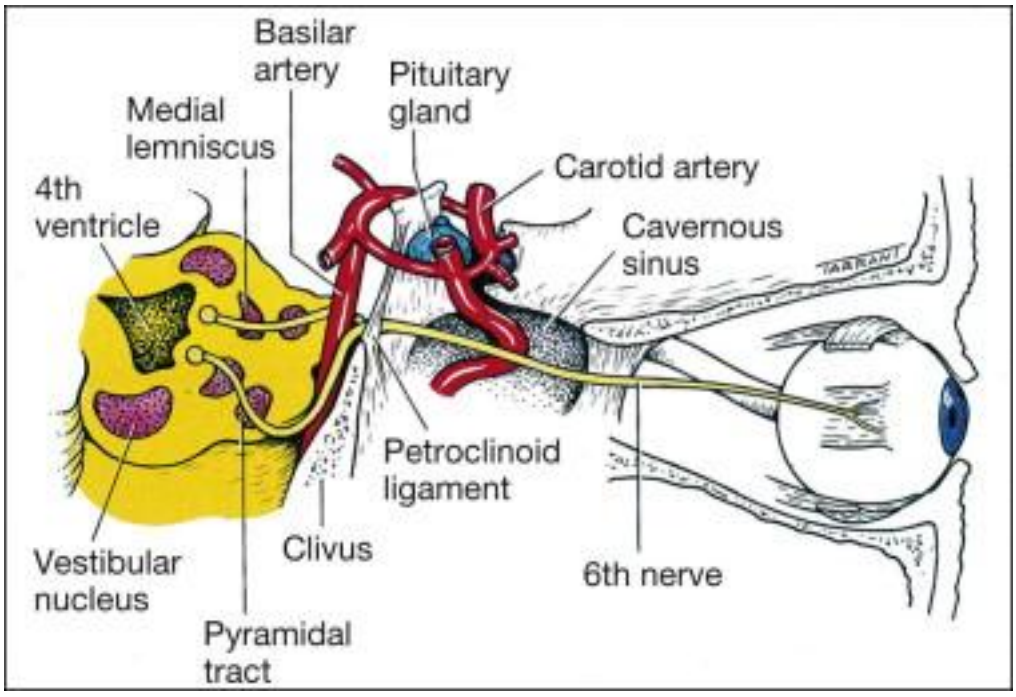
1. Cerebral cortex
    - Motor cortex (precentral gyrus) through the afferent corticonuclear fibres from both cerebral hemispheres.
    - Visual cortex, through the superior colliculus and tectobulbar tract.
    - Frontal eye field.

2. Nuclei of 3rd, 4th and 8th nerves through medial longitudinal bundle.

3. Pretectal nucleus of both sides through the tectobulbar tract.

4. Horizontal gaze centre (PPRF) through the medial longitudinal bundle.

5. Cerebellum through the vestibular nuclei.



COURSE AND DISTRIBUTION:

FASCICULAR PART:

Starts with efferent fibres from the nucleus, traverse through tegmentum, parapontine reticular formation (PPRF) and pyramidal tract. These fibres then exit the brainstem at pontomedullary junction.

BASILAR PART:

Just after emergence, nerve enters in basilar cistern (prepontine part). Then it crosses upwards near the base of the skull where it is crossed by anterior inferior cerebellar artery. As it runs between pons and occipital bone, it turns upwards on the back of petrous temporal bone near its apex. At the sharp upper border of petrous bone, the nerve bends at right angle under petrosphenoidal ligament and enters the cavernous sinus.

INTRACAVERNOUS PART:

In the sinus, it runs forwards almost horizontally, being inferolateral to internal carotid artery and its sympathetic plexus. The nerve runs out at the anterior end of cavernous sinus and enters the superior orbital fissure. Within the annulus of Zinn, it lies in the middle part of superior orbital fissure. Abducent nerve lies inferolateral to nasociliary and oculomotor nerves.

INTRAORBITAL PART:

Nerve divides into 3-4 filaments which enter the ocular surface of lateral rectus muscle behind its mid point.

ETIOLOGY OF NERVE PALSIES

OCULOMOTOR NERVE:

NUCLEAR PORTION:

- Infarction
- Haemorrrhage
- Neoplasm
- Abscess

The involvement of paired medial rectus subnuclei produces bilateral internuclear ophthalmoplegia (WEBINO), characterized by exotropia, defective convergence and adduction. Oculomotor nuclear lesions are often associated with involvement of adjacent trochlear nerve nucleus.

FASCICULAR PORTION[2]:

- Infarction
- Haemorrhage
- Migraine – with MRI signal abnormalities during acute phase consisting of a thickening and enhancement of the nerve at its exit from the midbrain.
- Tumour
- Multiple sclerosis

- Stereotactic surgery

Syndromes associated with oculomotor nerve palsy:

BENEDICT SYNDROME:

Involves the fasciculus as it passes through the red nucleus. It causes oculomotor nerve palsy on same side and extrapyramidal signs on opposite side.

WEBER SYNDROME:

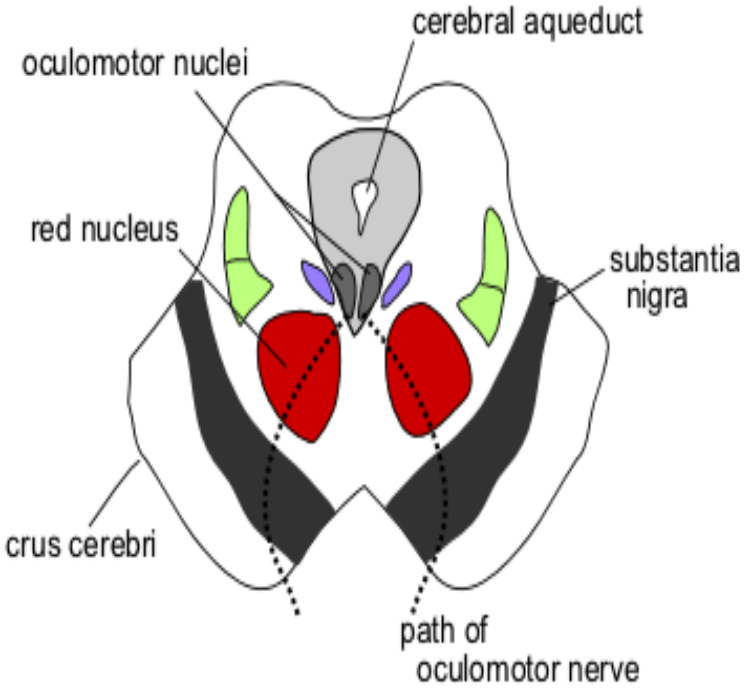
Involves fasciculus as it passes through the cerebral peduncle. Causes ipsilateral oculomotor nerve palsy and hemiparesis on opposite side.

NOTHNAGEL SYNDROME:

Involves fasciculus at the level of superior cerebellar peduncle. Causes oculomotor nerve palsy on the same side and cerebellar ataxia.

CLAUDE SYNDROME:

Combination of Benedict and Nothnagel syndrome.



SUBARACHNOID PORTION:

- Aneurysm
- Infectious meningitis
- Meningeal infiltrates
- Carcinomatous / leukemic infiltration, granulomatous inflammation .

BASILAR PORTION:

Basilar part of third cranial nerve is usually not accompanied by other cranial nerves, so isolated third nerve palsy is usually basilar.

Common causes are,

- Aneurysm:

Acute pupil involving third cranial nerve palsy is commonly caused by aneurysm of posterior communicating artery where it meets the internal carotid artery.

- Head Injury:

Extradural / subdural haematoma due to head injury causes a downward tentorial herniation of temporal lobe causing compression of the third cranial nerve as it crosses over the edge of tentorium, causing miosis first followed by mydriasis and later complete third cranial nerve palsy [10].

- Tumours of the third nerve
- Glioblastoma multiforme
- Sarcoidosis
- Wegeners granulomatosis
- Ophthalmoplegic migraine
- Pseudotumourcerebri
- Trauma
- Diabetes
- Atherosclerosis

INTRACAVERNOUS PORTION:

- Ischaemia from microvascular disease in vasa nervosa ex. diabetes , hypertension, etc
- Pituitary apoplexy (haemorrhagic infarction) may cause third nerve palsy if it impinges on the cavernous sinus.
- Giant aneurysm
- Cavernous sinus thrombosis
- Carotico -cavernous fistula
- Carotid dural branch-cavernous sinus fistula
- Tumour-pituitary adenoma, meningioma, craniopharyngioma, metastatic carcinoma

PITUITARY ADENOMA WITH CAVERNOUS SINUS EXTENSION

- Inflammatory-Tolosa Hunt syndrome(idiopathic or granulomatous inflammation)
- Mucocele of sphenoid sinus / sphenoid sinusitis
- Intraneural haemorrhage

Third nerve palsy in the cavernous region is usually associated with

- Fourth cranial nerve
- Sixth cranial nerve
- First branch of trigeminal nerve

INTRAORBITAL PORTION:

Superior and inferior division palsies of third nerve are commonly traumatic or vascular.

- Orbital pseudotumour
- Sphenoid sinus mucocele
- Tumour
- Trauma

UNKNOWN LOCALIZATION:

- Migraine
- Trauma
- Viral infections

- Lyme disease
- Subdural hematomas

TOXIC EFFECTS OF DRUGS:

- Cocaine
- Sildenafil citrate(Viagra)
- Infliximab
- Cisplatin
- Dental anesthesia
- Scorpion bite
- Radiation therapy

CAUSES OF NERVE PALSY IN CHILDREN:

- Congenital
- Traumatic
- Inflammatory
- Post viral syndromes
- Migraine
- Neoplasm

MEDICAL CAUSES OF THIRD NERVE PALSY:

- Diabetes and Hypertension
- Usually spares the pupil
- Microangiopathic conditions, causing ischaemia due to involvement of vasa nervosum.

CAUSES OF ISOLATED CN III PALSY[1]:

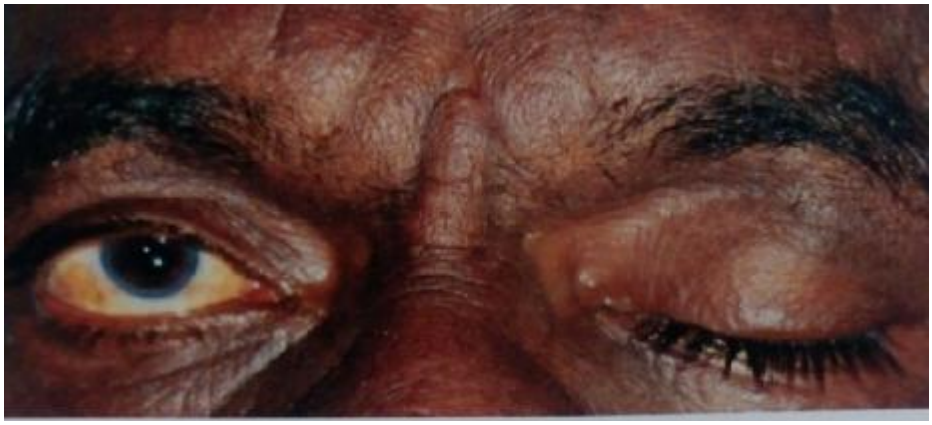
- Idiopathic
- Vascular diseases
    - Important cause of pupil sparing third cranial nerve palsy.
    - Periorbital pain may be associated with diabetic third nerve palsy.
    - In some occasions, may be the first feature of diabetes.
    - Spontaneous recovery can occur in three months.
- Aneurysm
    - Occurs in Posterior communicating artery where it meets the internal carotid artery.
    - Pupillary involvement.
- Trauma
    - Subdural haematoma associated with tentorial herniation.

- Minor head trauma presenting with nerve palsy should alert of a intracranial tumour causing the nerve to be stretched and tethered.

MISCELLANEOUS CAUSES:

- Intracranial tumours
- Syphilis
- Meningitis
- Giant cell arteritis
- Collagen vascular disorders
- Migraine
- Internal carotid artery dissection
- Chemotherapeutic toxicity

SIGNS OF THIRD NERVE PALSY[1]:



- Weakness of levator muscle leading onto drooping of lid.
- Abducted eye in primary gaze due to lateral rectus overaction.
- Normal abduction
- Intorted eye on downgaze due to normal superior oblique muscle
- Adduction limitation due to weakness of medial rectus muscle.

- Elevation limitation due to weakness of superior rectus and inferior oblique muscles.
- Limited depression due to weakness of inferior rectus.
- Parasympathetic palsy leading to dilated pupil with defective accommodation.

ABERRANT REGENERATION:

- Can follow acute trauma or any lesion causing compressive third nerve palsy.
- Other causes include aneurysm, migraine, syphilis but is never caused by ischaemic neuropathy.
- Long standing lesions within cavernous sinus, such as meningiomas, trigeminal neuromas, pituitary tumours may present with it.
- Posterior communicating aneurysm, abetalipoproteinemia may have primary aberrant regeneration. Severe head trauma can cause synkinesis between third and fourth nerve, resulting in misdirection of nerve fibres to the right medial rectus and right lateral rectus.
- In vascular pathology, endoneural nerve sheaths are intact and it is involved in traumatic and compressive lesions
- Elevation of upper eyelid on abduction or depression. (pseudo von grafe sign)

- Regenerating axons are misdirected which reinnervate the wrong muscle.
- Pupillary involvement may be seen.

TROCHLEAR NERVE:

NUCLEAR-FASCICULAR SYNDROME[2]:

- Haemorrhage
- Infarction
- Demyelination
- Trauma

SUBARACHNOID SPACE SYNDROME:

- Trauma
- Basal meningitis
- Neoplasms like pinealomas, tentorial meningiomas and aneurysms. Anterior medullary velum involvement causes bilateral fourth nerve palsy.

CAVERNOUS SINUS SYNDROME[5]:

- Associated with other cranial nerve palsies like third, fifth, sixth and ocular sympathetic paralysis.

ORBITAL SYNDROME[4]:

- Seen in trauma, inflammation and tumours.
- Seen in association with other cranial nerve palsies.
- Associated orbital signs are proptosis, chemosis and conjunctival injection.

CAUSES OF ISOLATED FOURTH NERVE PALSY[2]:

CONGENITAL:

- Common
- Can manifest in adulthood as it decompensates.
- Patients are unaware of torsional aspect.
- To make an accurate diagnosis, old photos are helpful.

ACQUIRED:

- In ischaemic conditions like diabetes and hypertension
- Trauma
- Vascular
- Herpes zoster

SIGNS OF FOURTH NERVE PALSY:

- Vertical diplopia-sudden onset with absence of ptosis
- Characterized by abnormal head posture

- Identical features will be there in nuclear ,fascicular and peripheral fourth cranial nerve palsy.

CHARACTERISTICS OF RIGHT CN IV PALSY:

- Right hypertropia in primary gaze.
- On right gaze, there is an increase in right hypertropia due to right inferior oblique overaction
- Limitation of levodepression of right eye.

ABDUCENT NERVE:

Abucent nerve nucleus involvement cause the following features:

- Abduction limitation on same side
- Absence of horizontal gaze towards the side of lesion seen due to involvement of the horizontal gaze centre in parapontine reticular formation.

FASCICULAR PORTION:

Syndromes related to fascicular portion are

1. **FOVILLE SYNDROME:**

- While passing through the PPRF, it affects the fasciculus.
- Dorsal pons involved due to tumours or vascular disease.
- Involvement of fifth to eighth cranial nerve on the same side.
- Central sympathetic fibres
- Facial analgesia dut to fifth cranial nerve involvement
- Sixth cranial nerve palsy
- Deafness due to eighth cranial nerve involvement
- Central horner syndrome

2. **MILLARD GUBLER SYNDROME:**

Fascicular involvement occurs as it passes through pyramidal tract and frequent causes are intracranial tumours

Features are,

- Sixth nerve palsy on the same side.
- Hemiplegia on the opposite side.
- Dorsal pontine lesion leading onto variable signs.

BASILAR PORTION:

I. Acoustic neuroma

Damages sixth nerve at the level of pontomedullary junction

- Hearing loss is the first manifestation.
- Diminished corneal sensation is the first sign.

II. Nasopharyngeal tumours:

During its basal course, it damages the nerve by invading the skull and its foramina.

III. Increased intracranial pressure:

Due to posterior fossa tumours or idiopathic intracranial hypertension leading onto downward displacement of the brainstem stretching the abducent nerve over the petrous tip.

IV. Base of the skull fracture:

Causes both unilateral and bilateral sixth cranial nerve palsies.

V. Gradenigo syndrome:

Due to acute petrositis characterized by facial weakness, facial pain and hearing loss.

INTRACAVERNOUS PORTION:

- Passes through the middle of the cavernous sinus where it is closely related to internal carotid artery, so it is damaged by the internal carotid artery aneurysm.

SIGNS OF RIGHT SIXTH NERVE PALSY:

- Right esotropia in the primary gaze due to overaction of right medial rectus
- Esotropia becoming worse for distance and less for near target
- Marked limitation of right abduction
- Normal right adduction
- Compensatory face turn.

FUNDAMENTAL LAWS GOVERNING OCULAR MOTILITY

HERING'S LAW OF EQUAL INNERVATION:

It states that equal and simultaneous innervations flows from the brain to the pair of yoke muscles in both the eyes which contract simultaneously in different binocular movements.

CLINICAL APPLICATION:

- Secondary deviation
- Inhibitional palsy of the contralateral antagonist muscle

SHERRINGTON'S LAW OF RECIPROCAL INNERVATION:

This law states that during ocular motility an increased flow of innervations to the contracting agonist muscle is accompanied by a decreased flow of innervations to the relaxing antagonist muscle.

Clinical application:

- Occurrence of strabismus following paralysis of EOM occurs due to this law
- Reciprocal innervations

MULTIPLE CRANIAL NERVE PALSIES:

Causes include[10]

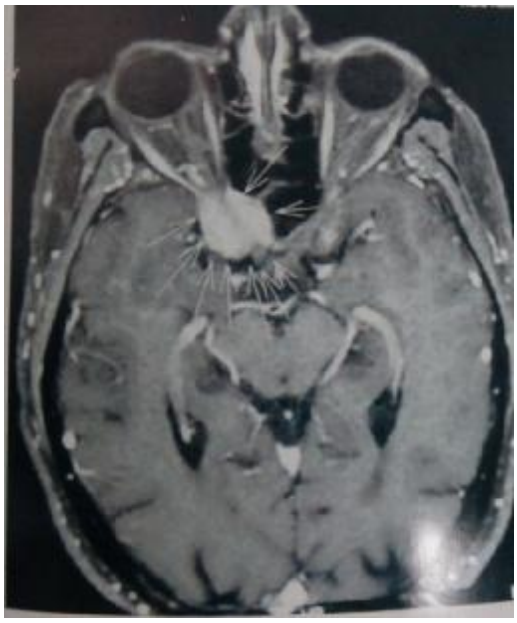
- Head trauma
- Orbital pseudotumour
- Pituitary tumour
- Nasopharyngeal carcinoma
- Cerebellopontine angle tumour
- Brain stem glioma

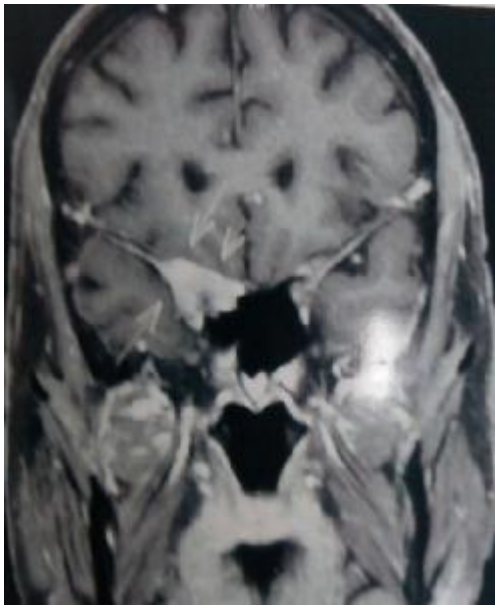
- Metastasis
- Tolosa hunt syndrome
- Cavernous sinus /superior orbital fissure syndrome
- Cavernous sinus thrombosis
- Orbital apex syndrome

ORBITAL APEX SYNDROME[4]:

Visual loss from optic nerve involvement and limitation of ocular movements due to multiple cranial nerve palsies constitutes the features of orbital apex syndrome. It is associated with damage to the III, IV, VI cranial nerves and ophthalmic branch of trigeminal nerve (V1) in association with optic nerve dysfunction. The cavernous sinus syndrome includes features of orbital apex syndrome along with involvement of maxillary branch of trigeminal nerve (V2) and oculosympathetic fibres. Superior orbital syndrome involves lesions, immediately anterior to the orbital apex, where the optic nerve is spared.

These terminologies define the precise anatomic locations, but the pathological process persay is contiguous and the etiology and management of these syndromes are similar. The etiologies of these syndromes can be varied ranging from infectious, inflammatory, neoplastic, vascular, traumatic or iatrogenic.





SECONDARY DEPOSITS AT ORBITAL APEX CAUSING

ORBITAL APEX SYNDROME

DIFFERENTIAL DIAGNOSIS:

Inflammatory:

- Tolosa hunt syndrome
- Churg strauss syndrome
- Systemic lupus erythematosus
- Wegeners granulomatosis
- Giant cell arteritis
- Sarcoidosis
- Thyroid orbitopathy

- Orbital pseudotumour

Infectious:

- Bacteria : Streptococcus., Staphylococcus, Gram Negative Bacilli
- Spirochetes: Treponema pallidum
- Fungi: Aspergillosis, Mucormycosis
- Viruses: Varicella zoster

Neoplastic:

- Head and neck tumours: nasopharyngeal carcinoma, adenoid cystic carcinoma
- Neural tumours: neurofibroma, meningioma, schwanomma
- Distant Metastasis: lung, breast, renal cell carcinoma, malignant melanoma
- Hematologic: leukemia, Burkitts lymphoma, non Hodgkin s lymphoma
- Perineural invasion of cutaneous malignancy

Iatrogenic:

- Sinus surgery
- Orbital/ faciomaxillary surgery

Traumatic:

- Penetrating
- Non penetrating
- Retained foreign body
- Orbital apex fracture

Vascular:

- Carotid cavernous fistula
- Cavernous sinus thrombosis
- Carotid cavernous aneurysm

TOLOSA HUNT SYNDROME:

THS affects all people regardless of age. There is no sex or laterality predilection and some cases of bilateral simultaneous involvement have also been reported. It is generally acute in onset. Pain is the most predominant and defining symptom. If untreated, it lasts for an average duration of 2 months. The pain is intense, severe and gnawing, periorbital, sometimes radiating to the retroorbital, frontal and temporal regions.

Motor cranial nerve palsy can occur in various permutations and combinations. Vision loss is variable and unpredictable. It may range from minimal, reversible to permanent blindness.

NEUROIMAGING

Advances in physics, computers and imaging science in the last century has seen neuroimaging evolve to form plain X-ray to CT scans, MRI scans, CT angiography, MR angiography[7] and special sequences like fat supression, fluid attenuation recovery and diffuse weighted imaging. Prompt prescription of an appropriate imaging modality and the most suitable sequence can increase the diagnostic yield and in many instances can prove a sight saving and even a life saving decision.

COMPUTED TOMOGRAPHY (CT):

CT machine consists of an assembly with X-ray detector on one side and collimated source of X-rays on the other side. The X-ray tube and the detector rotate around the patient.

The X-rays get attenuated when they pass through the tissues. The computer reconstructs the image from the data points resulting from the attenuation of X-ray beams. The appearance of a tissue on a CT scan thus depends upon the amount of X-ray attenuation it causes. It can be[7]

- Isodense
- Hypodense – cyst, infarct, fat and white matter edema
- Hyperdense – haemorrhage, calcium, bone and contrast.

CT PROTOCOL:

When CT scan is ordered, it is important for the consulting ophthalmologist to indicate whether the CT scan must include the orbit, the head or both.

AXIAL SCANS:

- Taken along Reid's anatomic baseline /- 10 degree to orbitomeatal line.
- 3mm and 5mm thick plain axial sections
- 3mm thick post contrast scans (axial and coronal).

CORONAL SCANS:

For examination purposes, the best orientation would be coronal slices of intervals of less than or equal to 3 mm. Using the axially acquired data set, three dimensional reconstructions can be created, which can dramatically demonstrate the anatomic relationships between osseous defects and sinus, orbital or intracranial disease[8] . It is taken perpendicular to Reid's anatomic baseline with the patient in either supine or prone position[3].

The slices that are taken at different levels are

Brain -5 mm slices through posterior fossa

-10 mm slices through supratentorial brain parenchyma

Optic nerve – 2mm thick axial sections

ADVANTAGES OF CT[15]:

- Ease of performing the procedure
- Rapid image acquisition
- Wider availability
- Excellent spatial resolution
- Greater anatomical coverage
- 3 dimensional reconstruction for orbital and facial fractures
- Ability to identify acute bone and blood abnormalities.

DISADVANTAGES OF CT:

- Difficult multiplanar imaging
- Allergic reactions to contrast agents
- Poor resolution adjacent to bone or other radiodense objects
- Exposure to radiation

CT IS DONE IN CASES OF

- Trauma
- Assessment of bony abnormalities
- Detection of calcification in lesions
- Sinus and lacrimal disorders
- Situations where MRI is contraindicated
    - Ferromagnetic foreign bodies
    - Pacemakers
    - Metallic cardiac valves
    - Cochlear implants
    - Aneurysmal clips
    - Claustrophobic patients

CT WITH CONTRAST:

Injection of intravenous contrast media is an adjunct to CT scanning. These dyes do not cross the blood brain barrier[7]. If the blood brain barrier is disturbed, the concentration of the dye is increased in abnormal tissues. The contrast material may be

- Iodinated contrast
- Ionic, combined with sodium and meglumine salts
- Non – ionic

In general, the use of contrast improves the sensitivity and specificity.

MAGNETIC RESONANCE IMAGING (MRI):

The MR signal is generated from the interaction of hydrogen protons within the powerful magnetic field in the body. The technique depends on the physical properties of soft tissue for image generation. When placed in a powerful magnetic field, hydrogen nuclei of soft tissue align themselves along the magnetic field[21]. These nuclei are transiently perturbed by radio frequency pulses; rate of relaxation depends upon the specific magnetic properties of the tissue, which results in tissue specific signals. The static magnetic field created by the MRI scanner is expressed in the unit Tesla.

Unlike CT scanning, which relies on the density of tissue to determine the attenuation of signal, the language of MR is signal intensity. Examples of MRI pulse sequences are as follows:

T1-weighted sequence: cerebrospinal fluid and vitreous look dark, whereas fat is bright.

T1 orbital sequence with gadolinium and fat suppression: The typically bright orbital fat is presaturated with an additional radiofrequency pulse to eliminate its signal and make it dark. Gadolinium is administered to enhance pathology. This sequence is useful for detecting optic nerve sheath meningiomas and optic neuritis, which take up gadolinium and look bright. Proton density axial fast-spin echo.

T2-weighted sequence: CSF and vitreous look white.

T2-weighted sequence with fat suppression: this sequence is optimal for imaging the anatomy of the optic nerve and perioptic CSF space.

Fluid attenuated inversion recovery (FLAIR)[3]:

This method eliminates bright signal from fluid, allowing a strong T2 weighted image to remain, which is useful for identifying multiple sclerosis plaques and ischaemia.

Diffusion- weighted sequence (DWI):

This sequence is used to image acute cerebral infarctions within the first hour of stroke. These sequences are not detected on other MRI sequences or on CT scan. Ischaemia looks bright on DWI.

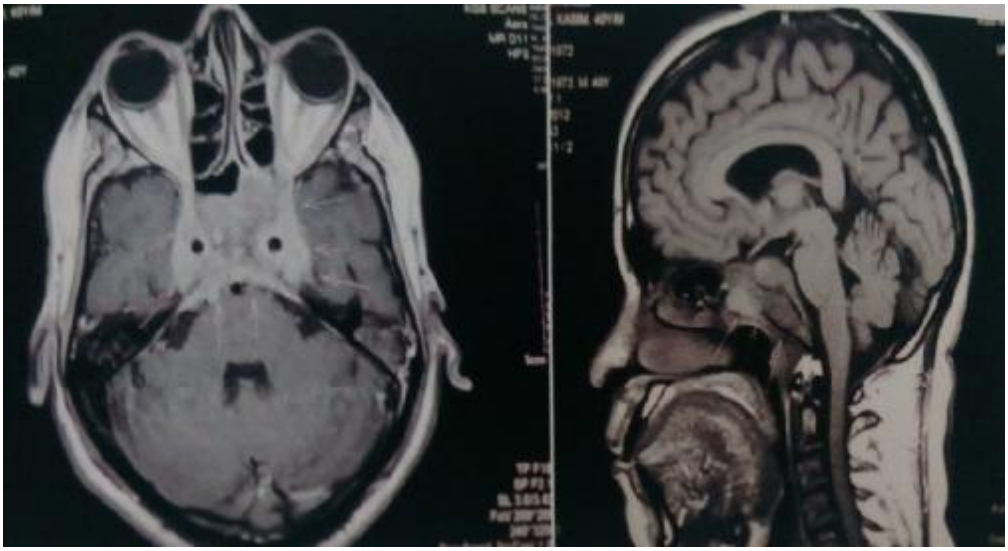
Pathology appearance on MRI:

Black on T1 and T2: calcium, gas, rapidly flowing blood, fibrosis, hemosiderin (chronic hematoma), deoxyhaemoglobin (acute hematoma) and cortical bone.

White on T1 and T2: Subacute hematoma, proteinated fluid and stationary or slowly flowing blood (hemangioma).

White on T1: fat, fatty bone marrow, lipoma

Black on T1 and white on T2: edema, tumour, demyelination, infection and infarction.



MRI showing expansile and destructive lesion involving sphenoid sinus with encroachment into both sides of cavernous sinus, encasing ICA suggesting possibility of sphenoid malignancy with cavernous extension.

GADOLINIUM ENHANCEMENT:

Gadolinium is a paramagnetic substance that shortens relaxation times of T1 and T2 weighted sequences. On T1 weighted sequences, it appears bright or hyperintense. The pituitary gland, extraocular muscle, choroid plexus and nasal mucosa normally lack a blood brain barrier, therefore , they enhance with gadolinium[16].

ADVANTAGES OF MRI:

- Provides a non- ionizing three dimensional view.
- Useful particularly in imaging posterior fossa, because typical CT artefact owing to bone is completely avoided.
- Useful in imaging soft tissue lesions

- Better in detecting optic neuritis and optic nerve sheath meningiomas than CT.

MRI SHOWING LESION IN CAVERNOUS SINUS

DIGITAL SUBTRACTION ANGIOGRAPHY (DSA):

DSA uses typical ionising radiation (x-rays) and iodine –based intravascular contrast material delivered through a catheter. DSA subtracts other structures like bone by using a mask image, which is essentially a photoreversal of field of view. Computer software subtracts a negative image from a positive image. It is used to detect atherosclerotic disease in the carotid artery and to identify and treat intracranial vascular pathology, including aneurysm, arteriovenous malformation and caroticocavernous

fistula. DSA remains the gold standard for imaging the extracranial and intracranial vessels and specifically for detecting cerebral aneurysms.

VASCULAR IMAGING:

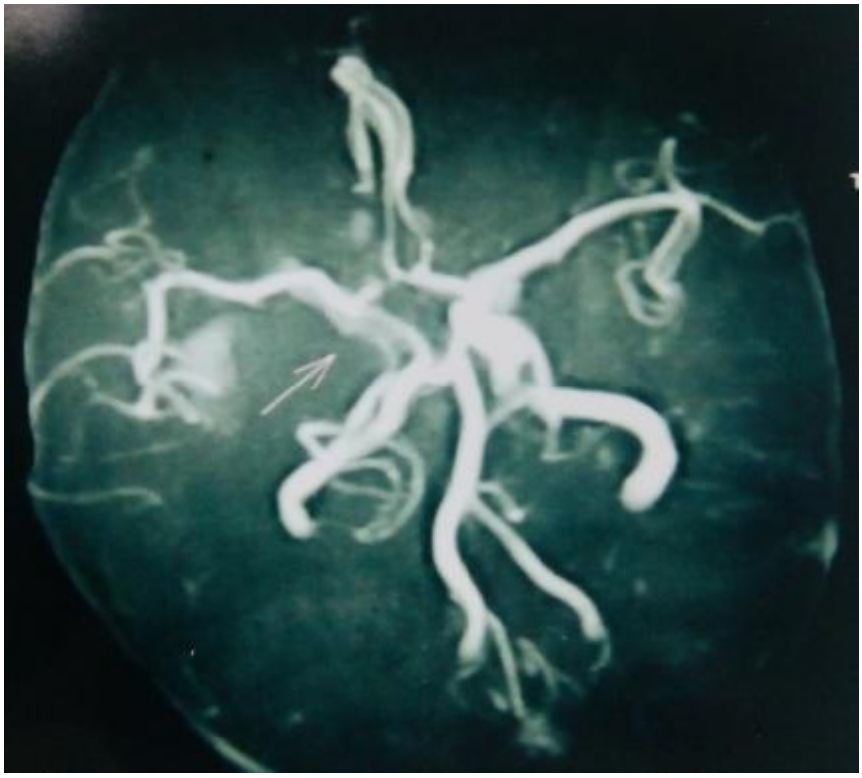
MR Angiography:

Relies on the flow sensitive nature of MR signal. There are two basic types of MR signal:

1. Time of Flight (TOF) MRA

2. Phase contrast (PC) MRA. It explorates data obtained from characteristic flow patterns of protons to assess the anatomy[3]. MRA is indicated in the following conditions.;

- Carotid artery stenosis
- Aneurysms
- Occlusive disease
- Carotid artery fistulas
- Plaques and dissections
- Arteriovenous malformations



MRA –SHOWING GIANT THROMBOSED ANEURYSM OF ICA

LIMITATIONS[19]:

- Aneurysms less than 5 mm cannot be detected.
- Yield false positive results in cases of tightly wound vessel loops.
- May exaggerate vessel stenosis.

MR angiography is the appropriate non invasive technique for diagnosing aneurysms >5 mm in size.

ADVANTAGES:

- Lack of ionising radiation exposure
- Less nephrotoxic contrast material
- Increased signal to noise ratio

- Easier post processing techniques

CT ANGIOGRAPHY:

CTA requires iodinated contrast. It is sensitive to detect aneurysm of >3 mm and stenosis of >70%. It involves intravenous injection of iodinated contrast, followed by high speed spiral CT scanning with computer generated 3D images of medium and large sized arteries.

BENEFITS

- Increased spatial resolution
- Less motion artifacts
- Technically easier
- Faster study to acquire
- Useful in patients with claustrophobia, pacemakers.

DISADVANTAGES:

- Difficulty in detection of cavernonus sinus and posterior inferior cerebellar artery aneurysms.
- Exposure to radiation
- Exposure to iodinated contrast agents

VENOGRAPHY[21]:

MR VENOGRAPHY /CT VENOGRAPHY:

A number of venographic techniques have been developed to better define sinus anatomy. These include phase contrast MRV, non contrast time of flight MRV, contrast enhanced MRV and CTV.

RECENT ADVANCES:

Includes

- Positron emission tomography(PET)
- Single photon emission computed tomography scan(SPECT)
- MR spectroscopy
- Functional MR imaging.

Neuroimaging is of prime importance in patients presenting with multiple cranial nerve palsies. A standard axial computed tomography of the head may not detect certain abnormalities. Contrast enhanced computed tomography (axial and sagittal planes) with large doses of contrast has become a better method of cavernous sinus imaging. If 5 mm slices are inadequate, overlapping 5 mm sections or non-overlapping 1.5 mm slices should be done.

High resolution CT is less sensitive than MRI. This is due to soft tissue change with superimposed beam hardening and bone streak artifacts. MRI is the modality of choice for detecting lesions of orbital apex. The

major limiting factor in the reliability of these MRI findings in Tolosa Hunt syndrome is that they are non specific[20].The signal characteristics (hypointense relative to fat and isointense with muscle on T1 weighted images; isointense with fat on T2 weighted scans) are also consistent with meningioma, lymphoma and sarcoidosis.

MRI is advantageous over CT in the following conditions[22]:

- Lesions of orbital apex, superior orbital fissure, optic canal
- Differentiation between optic nerve and periorbital lesions
- Differentiation between inflammatory pseudotumour and other malignant neoplastic processes with similar clinical presentation[24].
- Detection of neoplastic lesions with haemorrhagic foci or other paramagnetic materials (melanin).
- Detection of anomalous flow in vascular structures.

ROLE OF MRI VERSUS CT:

Orbital tumours[26]:

Intraocular tumours can be more readily identified and characterized with MRI, which is very complimentary with ultrasound. CT is very limited in this regard, although it is excellent for demonstrating calcification within ocular lesions, such as that seen with retinoblastoma.

Retro-ocular mass lesions are readily identified with both modalities. Calcifications are again more readily evident on CT scan. MRI sometimes provides more tissue specificity, depending on signal intensities. MRI is also very useful for demonstrating haemorrhage within lesions.

VASCULAR LESIONS[27]:

Both MRI and CT are excellent for showing arteriovenous malformations, arteriovenous fistulas and vascular malformations. Distensible varices sometimes are not apparent unless the patient performs a Valsalva maneuver or is positioned for direct coronal images. In this situation, MRI could miss the lesion since head position does not have to be changed in the MRI to get different views[29].

MRI shows high flow vessels as a signal void, whereas CT shows them as enhancement[8]. High flow vessels within the cavernous sinus are better seen on MRI, since enhancement of the cavernous sinus can obscure these vessels on CT whereas the high flow signal void on MRI will be highlighted against the enhancement of the cavernous sinus[28].

OPTIC NERVE LESIONS:

The optic nerve is well seen on both CT and MRI[29], although the intracanalicular and intracranial portion is not optimally visualized with CT. Most lesions of the optic nerve are well seen with both modalities, although calcification, as with sheath meningiomas, is much better shown on CT

whereas early changes of optic neuritis may only be seen on MRI because of signal intensity changes. The intracranial portion of the optic nerve as well as the optic chiasm is seen with both CT and MRI, although better seen with the latter.

In Idiopathic orbital inflammation and Graves Orbitopathy, both CT and MRI are extremely useful in imaging these conditions[9]. Both modalities can show changes within extraocular muscles.

REVIEW OF LITERATURE

1. **U.C. Park, S-J Kim et al described "clinical features and natural history of acquired third, fourth, and sixth cranial nerve palsy"**

Retrospective review on 206 patients with third, fourth and sixth nerve palsy were performed . The sixth nerve was most commonly affected and vascular disease was the most common etiology. Fourth nerve palsy was least frequent. With objective criteria based on deviation angle, overall recovery rate from nerve palsy was 85.2%. Patients who had a smaller eyeball deviation or successful management of treatable underlying disease had a high chance of recovery.

2. **Chou KL, Galetta SL, Volpe NJ et al studied "Acute ocular motor mononeuropathies: prospective study of the roles of neuroimaging and clinical assessment"**

Prospective study of 66 patients, aged 50 years and older with acute isolated ocular motor mononeuropathies was done. They evaluated the role of neuroimaging and the role of clinical assessment in determining etiology. High prevalence of microvascular ischemia was seen, other causes include aneurysms and neoplasms. They conclude that neuroimaging procedures

may have a role in the initial evaluation of patients 50 years or older with acute ocular motor mononeuropathies.

3. **Sonia Mehta et al described "Diagnostic and Economic yield of neuroimaging in neuroophthalmology"**

Two hundred and eleven imaging studies in 157 patients were evaluated. 28.9% of imaging studies had significant abnormalities relevant to neuroophthalmic complaint. Imaging obtained for evaluation of progressive optic nerve dysfunction and cranial nerve palsy had statistically significant higher diagnostic yield than studies performed for other reasons. They concluded that in comparison to the diagnostic yield of neuroimaging studies in other specialities, CT and MRI of the brain requested by neuroophthalmologists provide significant and relevant data at a reasonable cost.

4. **Andrew G.Lee, Paul W.Brazis et al studied "Imaging for neuroophthalmic and orbital disease"**

This article provides a brief summary of the most commonly used techniques of interest to ophthalmologists. They concluded that new imaging techniques for brain and orbit have an increased potential for improving diagnostic yield. Accurate and timely communication with the

neuroradiologist can optimize the prescription and interpretation of imaging in ophthalmology.

5. **SuleneL.Chi and M.Tariq Bhatti studied "The diagnostic dilemma of neuroimaging in acute isolated sixth nerve palsy"**

The aim of this review is to provide an update on the issues and controversies of neuroimaging in the initial evaluation of acute isolated sixth cranial nerve palsy. They concluded that clinical judgement and acumen are necessary to determine on a case by case series whether neuroimaging is needed in the initial evaluation of sixth cranial nerve palsy. If the risk factors for microvascular ischaemic disease are present the patients are managed initially with close observation and medical optimization of risk factors. However at any time during the follow up, if the sixth cranial nerve palsy progresses or additional cranial nerve palsies manifest, then neuroimaging is performed.

6. **Vimalamenon, Jagmohan Singh et al described "The etiological patterns of ocular motor nerve palsies"**

197 cases of both isolated and multiple cranial nerve palsies were included. Isolated sixth nerve palsy was the most common cause. Isolated 4^{th} nerve palsies were common in this series as compared to

other reports. Multiple cranial nerve palsies accounted for 17.3% of all the cases. The largest group consisted of cases with undetermined etiology.

7. **Situala S, Sharma AK et al described "Clinical manifestation of ocular motor nerve palsies in a tertiary Eye hospital of Kathmandu , Nepal"**

In this hospital based cross sectional descriptive study, 91 patients with ocular motor nerve palsies were examined. The most common identifiable etiology was vascular diseases followed by trauma. Cause was not identified in 40% of cases. Radiological investigations yielded more positive results in cases of combined cranial nerve palsies compared to cases with isolated ocular motor nerve palsies.

8. **Akshay Gopinathan Nair et al reported "The diagnostic yield of neuroimaging in sixth nerve palsy"**

110 cases of abducent nerve palsy were studied. Special interest was given on documenting the findings of neuroimaging studied. They reported that neuroimaging alone yielded results in cases where risk factors, clinical examination and lab investigations are not helpful.

AIM AND OBJECTIVES

AIM:

To report the diagnostic yield of neuroimaging in patients with ocular motor cranial nerve palsies.

OBJECTIVES:

- Describe and analyse the various clinical presentation.
- To evaluate the role of neuroimaging in determining the etiological diagnosis.
- Analyse the various evaluation and diagnostic modalities.

MATERIALS AND METHODS

STUDY DESIGN:

Hospital based prospective study

SOURCE OF DATA:

Department of Neuroophthalmology, Aravind Eye Hospital, Madurai.

DATA COLLECTED:

Demographic information, clinical history, comorbidities like diabetes, hypertension, thyroid disorder, myasthenia, IHD, symptoms, examination results, diagnosis, imaging modality, imaging findings.

SAMPLE SIZE:

196 patients who were diagnosed to have ocular motor cranial nerve palsies from a period of August 2014 to July 2015 for a period of 12 months who presented to the Department of Neuroophthalmology.

STUDY PERIOD:

August 2014 to July 2015(12 months)

DATA ANALYSIS:

Statistical Methods:

Mean (SD) or Frequency (Percentage) was used to describe summary information. All statistical analysis was done by STATA 11.1 (Texas, USA).

INCLUSION CRITERIA:

- All patients of isolated and multiple cranial nerve palsies who underwent neuroimaging.

EXCLUSION CRITERIA:

- Ocular motor cranial nerve palsies with h/o trauma
- Elderly patients, age >55 years with vasculopathic risk factors
- Congenital nerve palsies
- Other conditions that mimic cranial nerve palsies such as myasthenia gravis and thyroid orbitopathy.

CLINICAL EVALUATION:

A series of 196 patients who presented to our Neuro ophthalmology department with clinically proven diagnosis of isolated and multiple ocular motor cranial nerve palsies who underwent neuroimaging were included in our study and all these patients underwent a thorough ophthalmological and neurological evaluation

The patient particulars like name, age, sex, address were documented in a proforma specially designed for the study.

A detailed history of each and every symptom of the patient was taken, such as the onset, duration and associated factors were documented.

The patients were also enquired about the history of any previous similar history, history of trauma, systemic illness, surgical or medical intervention as which could influence the diagnosis.

Each one of the patient included in our study has to undergone routine

- Visual acuity by Snellan's chart
- Refraction
- Pupillary reaction for RAPD, sluggish pupil, dilated fixed pupil or normal pupil
- General ophthalmic examination by torch light and slit lamp

- Extraocular movement examination using torchlight
- Intraocular pressure measurement for patients above 40 years by non –contact tonometry
- Fundus examination by direct ophthalmoscope and slit lamp biomicroscopy using +90 dioptre lens and indirect ophthalmoscopy
- Hess and diplopia charting
- Colour vision by Ishihara's chart
- Central fields by Bjerrum's screen
- A complete neurological evaluation was done to every patient including general consciousness, cranial nerve examination, motor system evaluation (superficial and deep tendon reflexes), sensory system, cerebellar signs including gait, balance, rombergism, dysdiadochokinesia, fingernose testing and other system examinations were done.
- Neuroimaging was done in all patients either CT, MRI/MRV with or without contrast depending upon the need and affordability of the individual patients.
- Diagnosis was established based on clinical findings and neuroimaging . Basic blood investigations like random blood sugar, total leucocyte count, differential leucocyte count and erythrocyte sedimentation rate was done for all patients.

- Further blood investigations for granulomatous and autoimmune diseases like ANA, ACE levels, c ANCA, p ANCA were done in cases with strong clinical suspicion.
- Patients were referred for neurophysician, neurosurgeon, oncologist, ENT surgeons for further management depending upon the requirement.

ANALYSIS :

Analysis of collected data was done based on the following:

1. Age and sex distribution
2. Various symptoms
3. Onset of symptoms-Acute/subacute/chronic
4. Best corrected visual acuity
    a. 6/6 - 6/60 -1
    b. 5/60 - 1/60 -2
    c. <1/60 - 3
5. Anterior segment examination
6. Extraocular movement examination
7. Fundus examination
8. Colour vision –normal /abnormal
9. Central fields- normal/ abnormal

10. Central nervous system examination

11. Radiological findings

12. Treatment-medical /surgical

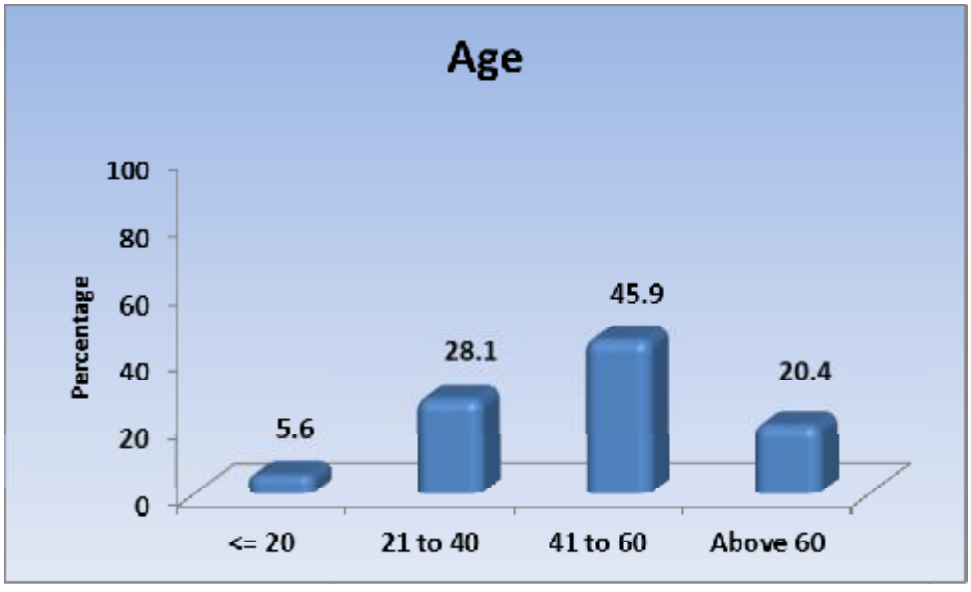
13. Referral

OBSERVATION

AGE DISTRIBUTION

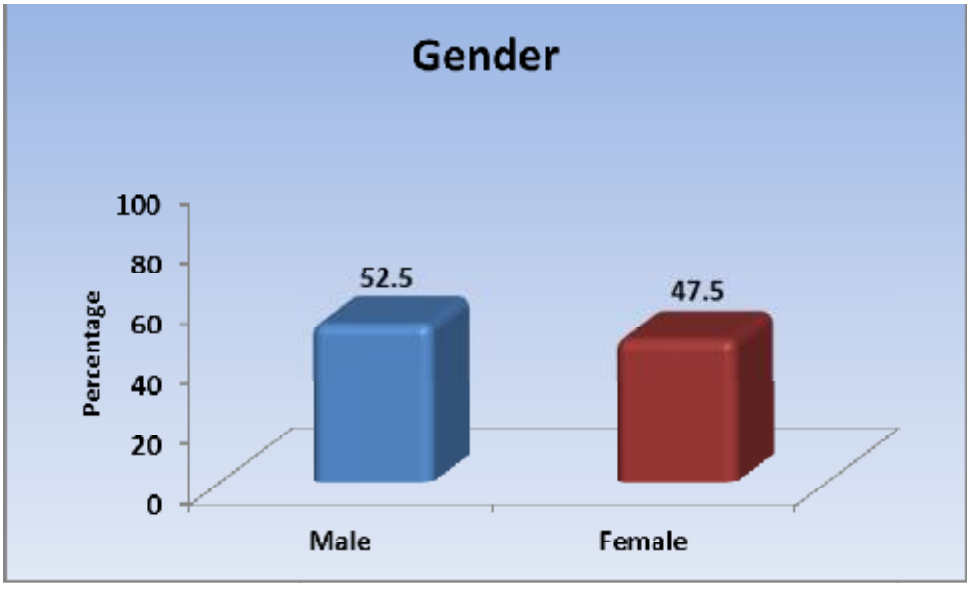
196 Patients were included in the study with age ranging from 1 to 80 years with a mean (SD) of the age is 46.94(15.87) years.

Age group	No. of cases	Percentage
<= 20	11	5.6%
21 to 40	55	28.1%
41 to 60	90	45.9%
Above 60	40	20.4%



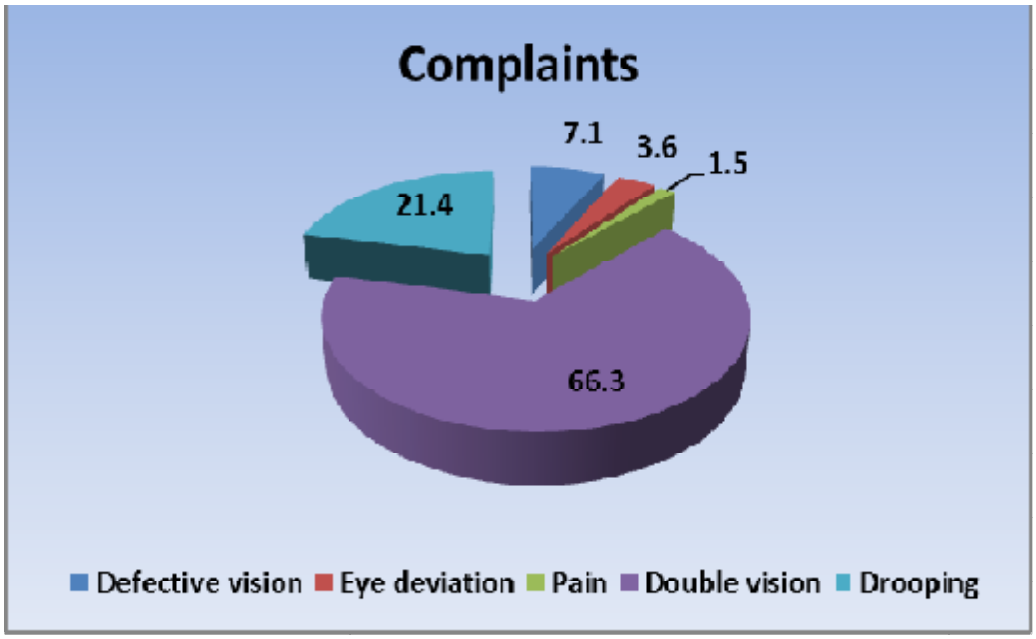
SEX DISTRIBUTION

Gender	No. of cases	Percentage
Male	103	52.5%
Female	93	47.5%



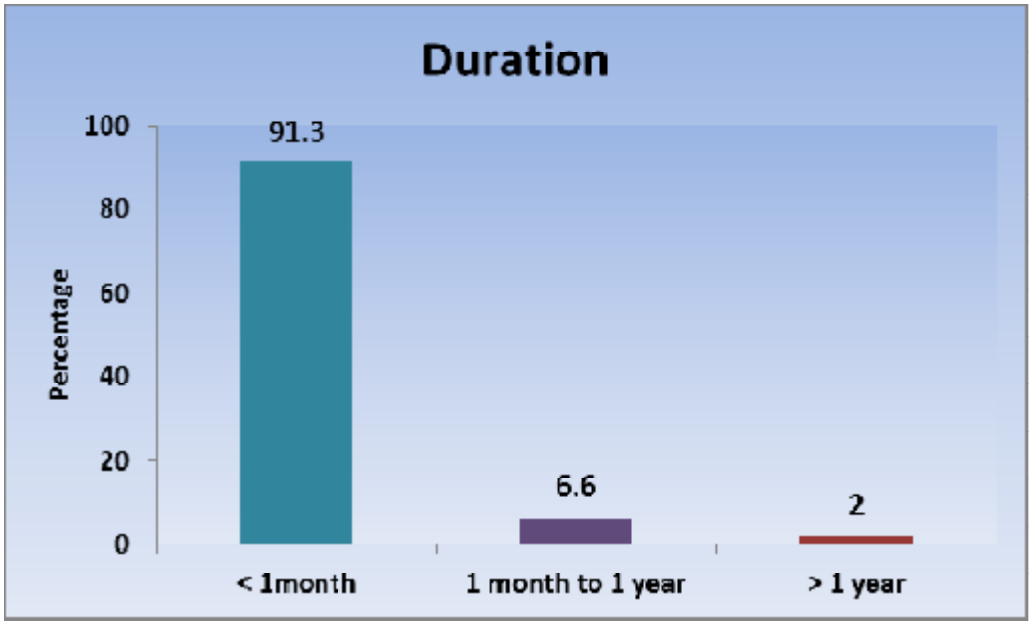
SYMPTOMS

Complaints	No.of cases	Percentage
Defective vision	14	7.1%
Eye Deviation	7	3.6%
Pain	3	1.5%
Double vision	130	66.3%
Drooping	42	21.4%



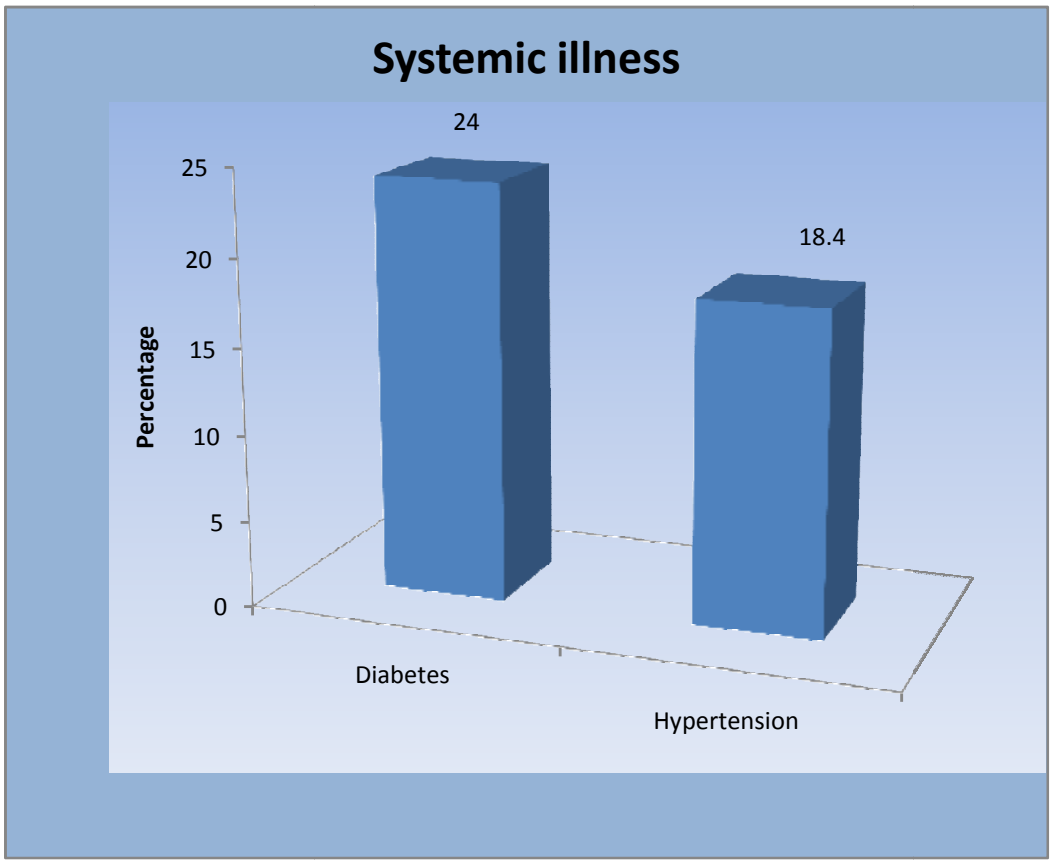
DURATION

Duration	Percentage
< 1month	91.3 %
1 month to 1 year	6.6 %
> 1 year	2 %



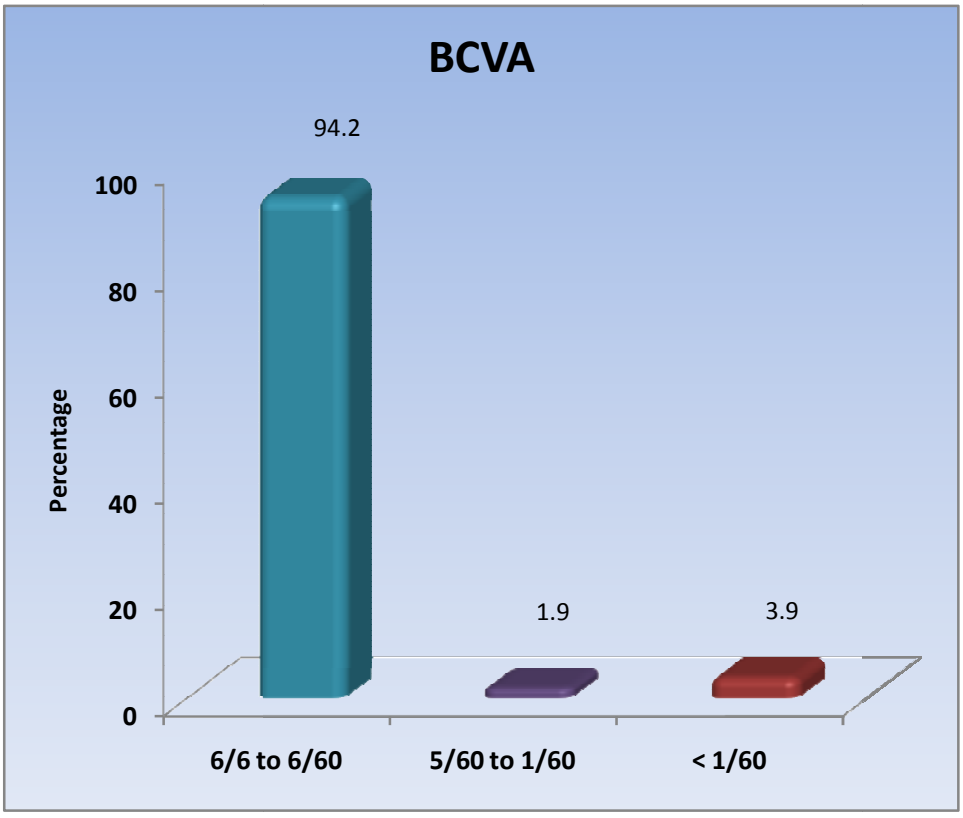
SYSTEMIC HISTORY

Systemic illness	Percentage
Diabetes	24%
Hypertension	18.4%



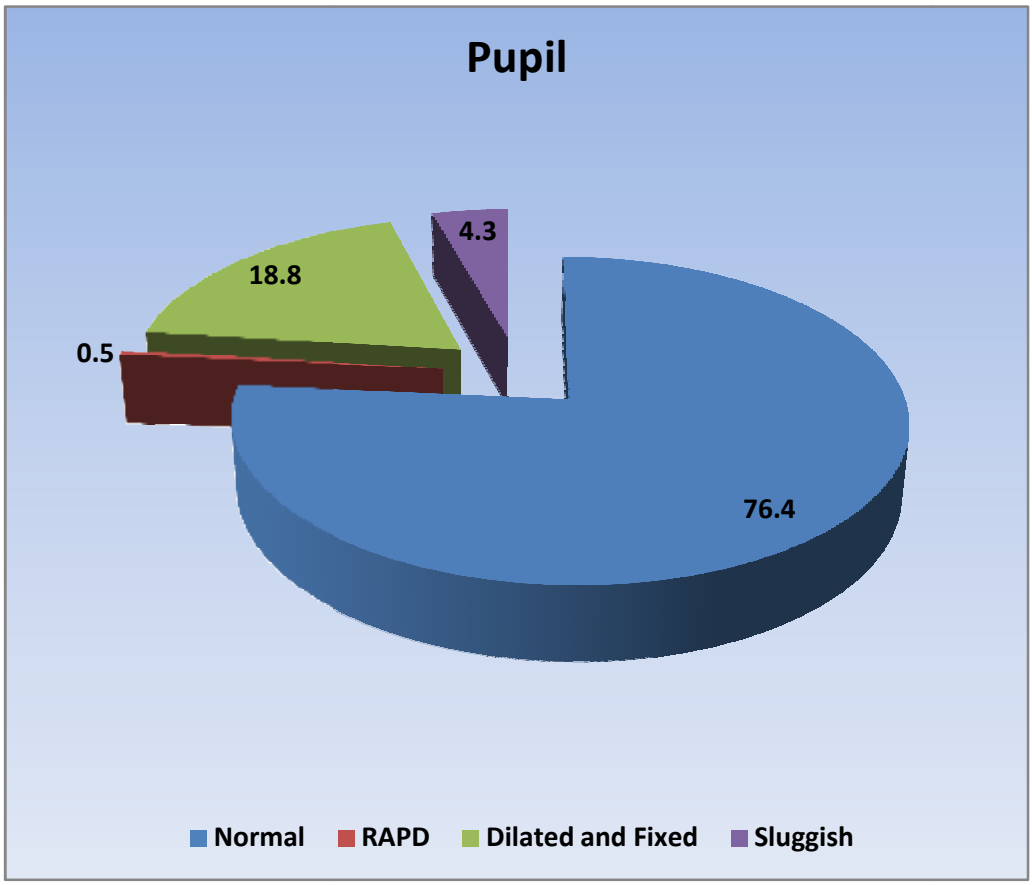
VISUAL ACUITY

BCVA	Percentage
6/6 to 6/60	94.2%
5/60 to 1/60	1.9%
< 1/60	3.9%



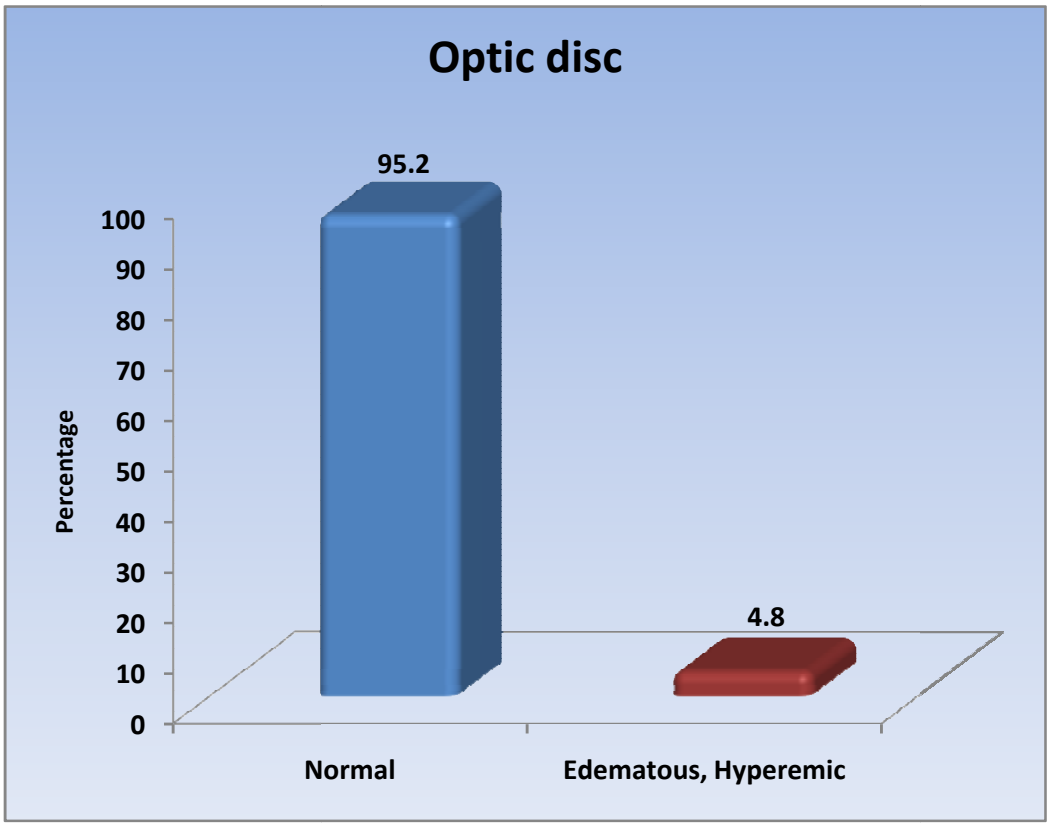
PUPIL

Pupil	Percentage
Normal	76.4%
RAPD	0.5%
Dilated and Fixed	18.8%
Sluggish	4.3%



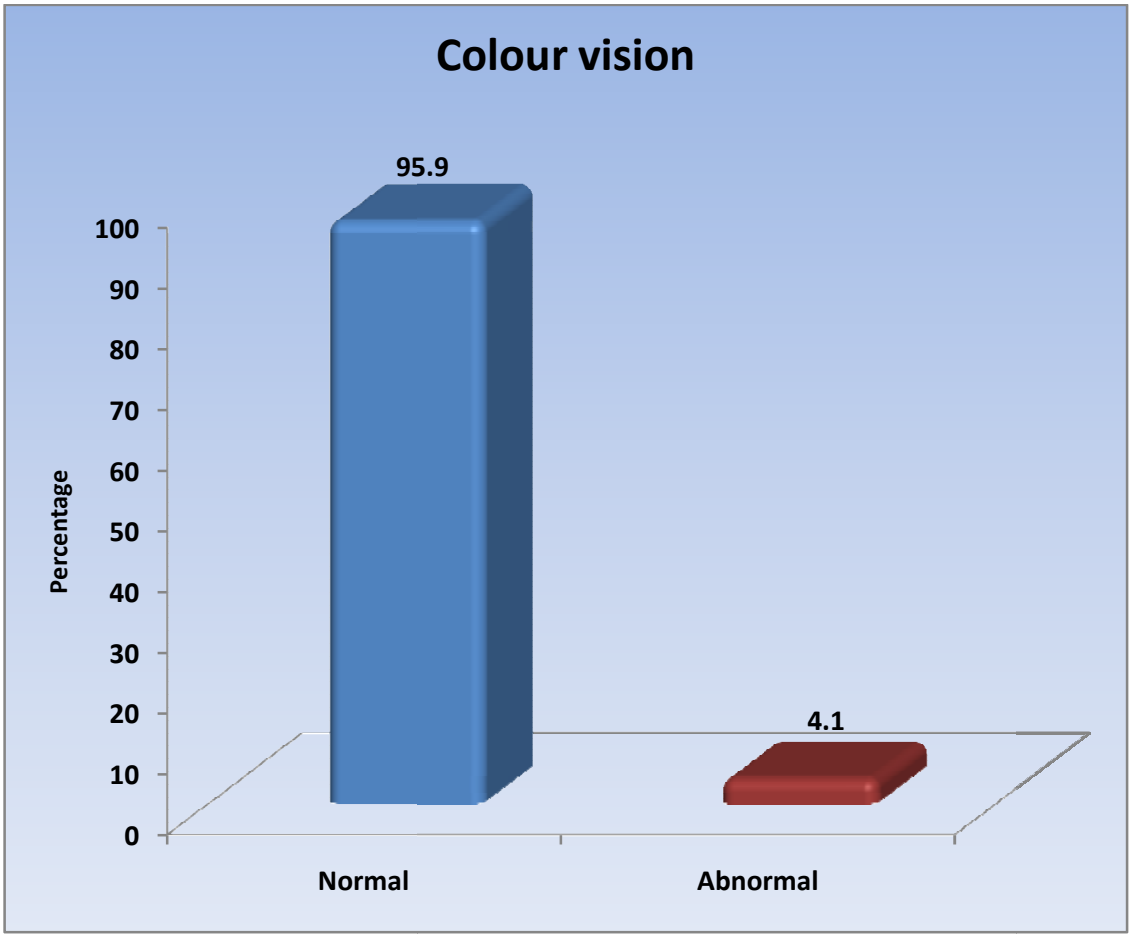
OPTIC DISC

Optic disc	Percentage
Normal	95.2%
Edematous, Hyperemic	4.8%



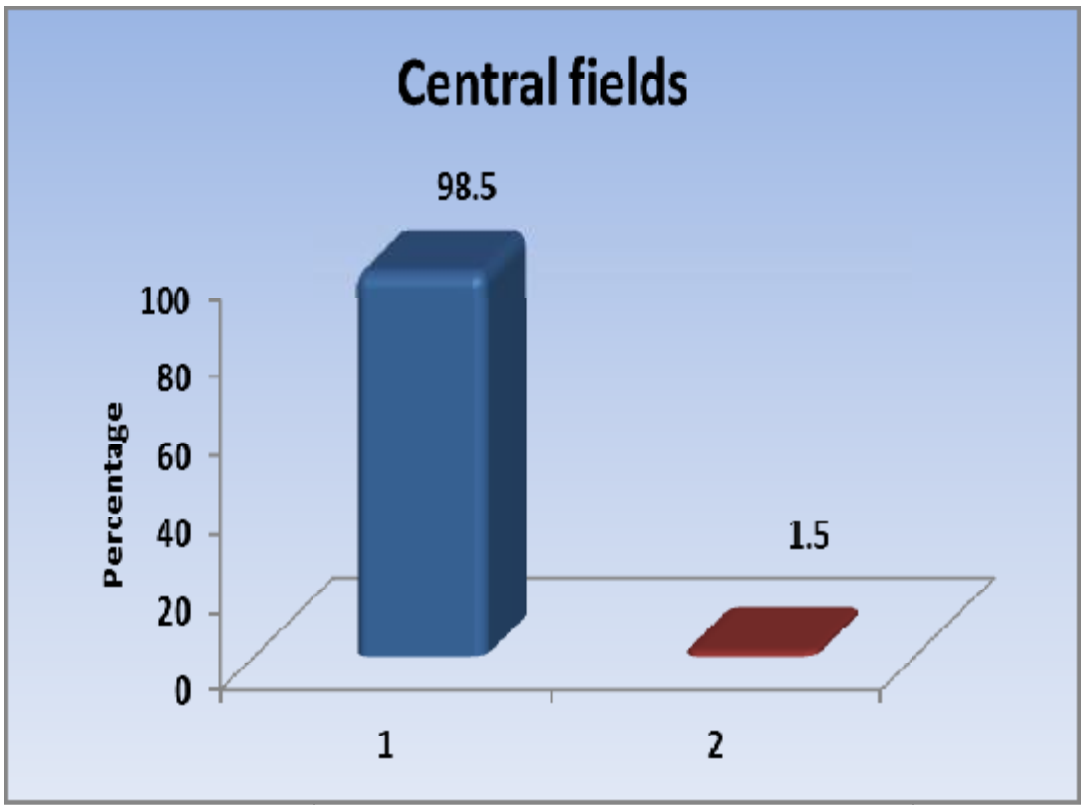
COLOUR VISION

Colour vision	Percentage
Normal	95.9%
Abnormal	4.1%



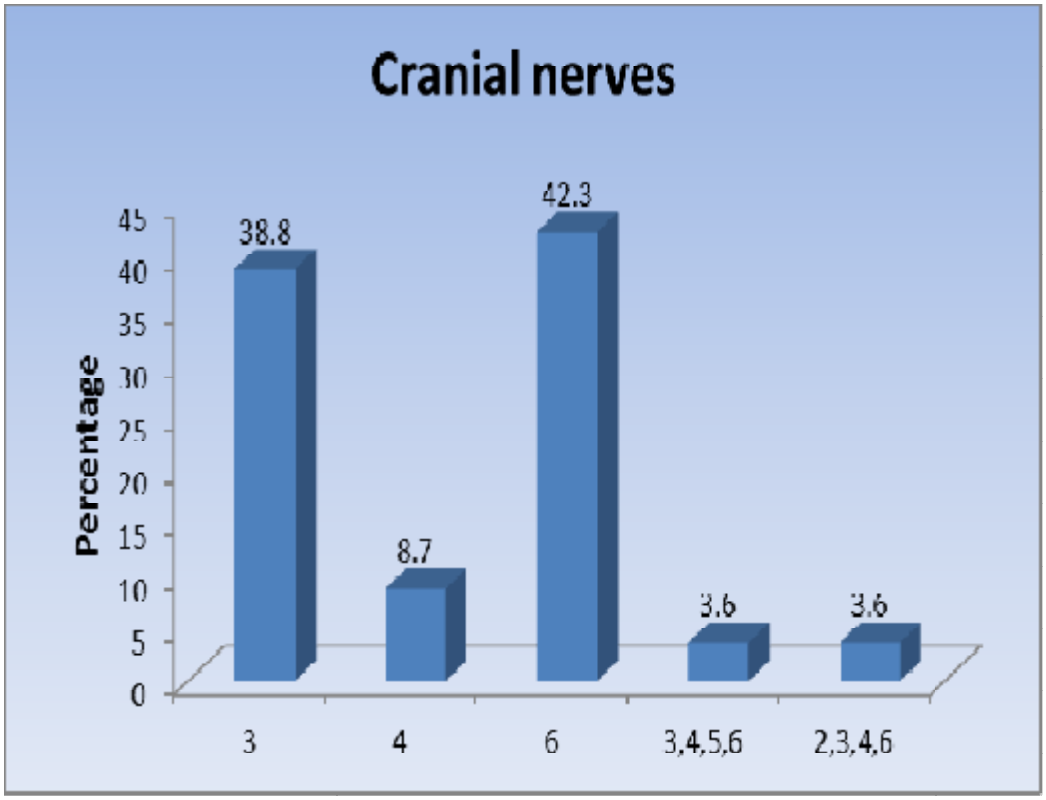
CENTRAL FIELDS

Central fields	Percentage
Normal	98.5 %
Abnormal	1.5 %



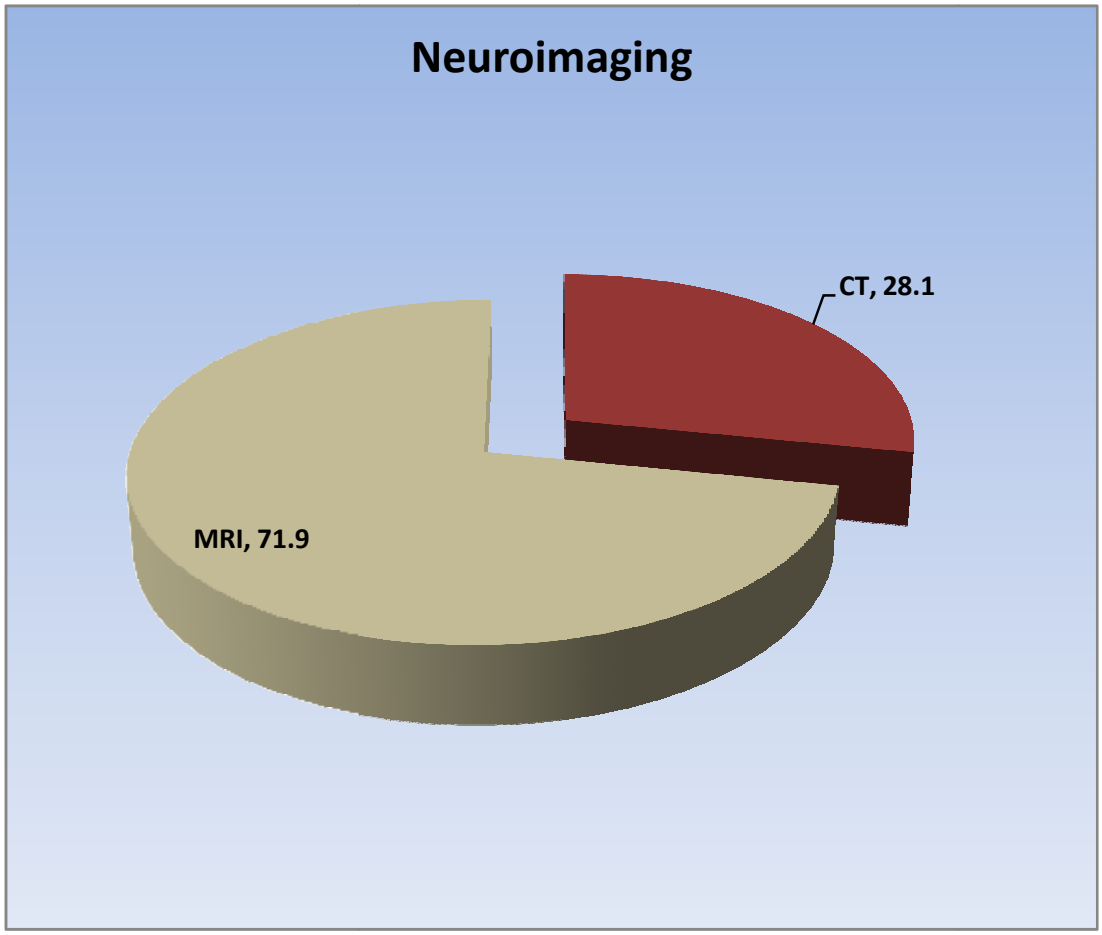
CRANIAL NERVE EXAMINATION

CRANIAL NERVES	Percentage
3	38.8%
4	8.7%
6	42.3%
3,4,5,6	3.6%
2,3,4,6	3.6%



NEUROIMAGING

Neuroimaging	Percentage
CT	28.1 %
MRI	71.9 %



NEUROIMAGING FINDINGS

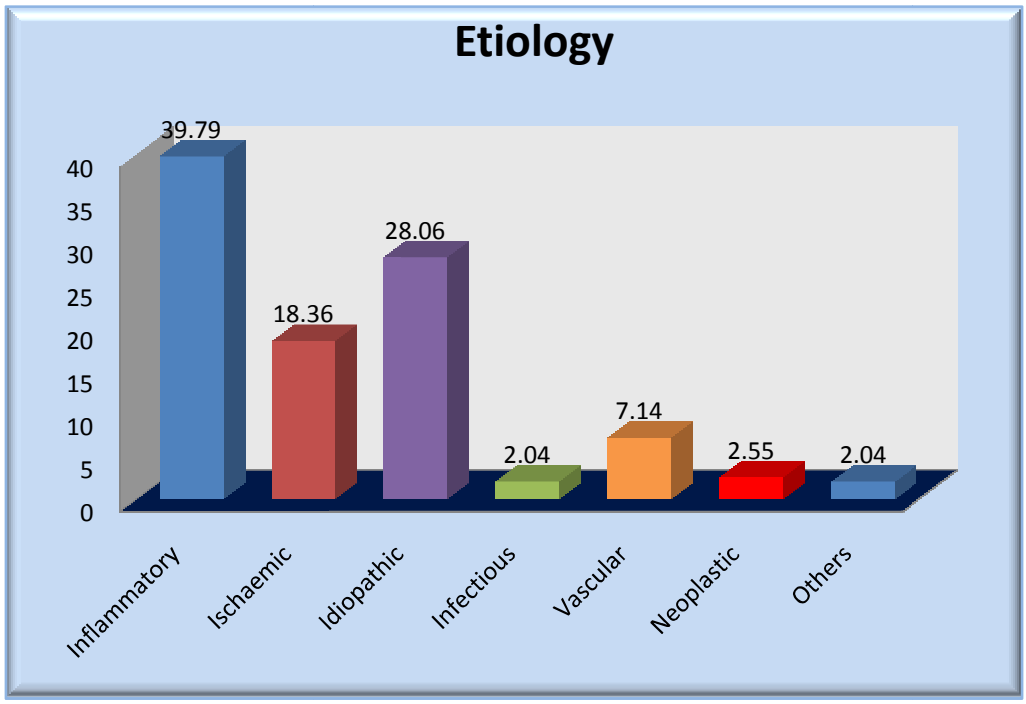
Diagnosis	N	Percentage
III Nerve Neuritis	4	2.0
Abducent Neuritis	2	1.0
Acute Infarct PCA	1	0.5
Basal Cranial Neuritis	1	0.5
Cavernous Sinus	26	13.3
CCF	2	1.0
Chronic Palsy	1	0.5
CVT	1	0.5
Dolicoectasia BA	1	0.5
Early frontotemporal Lobar Degeneration	1	0.5
Ectatic P1 Seg (R) PCA	1	0.5
Fungal Sinusitis	2	1.0
ICA Aneurysm	2	1.0
Idiopathic	55	28.1
Infarct	2	1.0
Ischaemic	35	17.9
Leptomeningitis	1	0.5
LR Myositis	1	0.5

NEUROIMAGING FINDINGS

MCA Infarct	1	0.5
Midbrain Infarct	2	1.0
ON Meningioma	1	0.5
Orbital Apex Syndrome	7	3.6
Pachymeningitis	3	1.5
Parietal Infarct	1	0.5
Petroclinoid ligament	1	0.5
Sinonasal Malignancy	1	0.5
Skull Base Meningioma	1	0.5
SOF Syndrome	31	15.8
Sphenoclival Malignancy	1	0.5
Sphenoidal Mucocele	1	0.5
Subacute Meningitis	1	0.5
Suprasellar Cyst	1	0.5
TB Meningitis	2	1.0
Tumour Extension	1	0.5
UBO/MBO/ Ischaemia	1	0.5

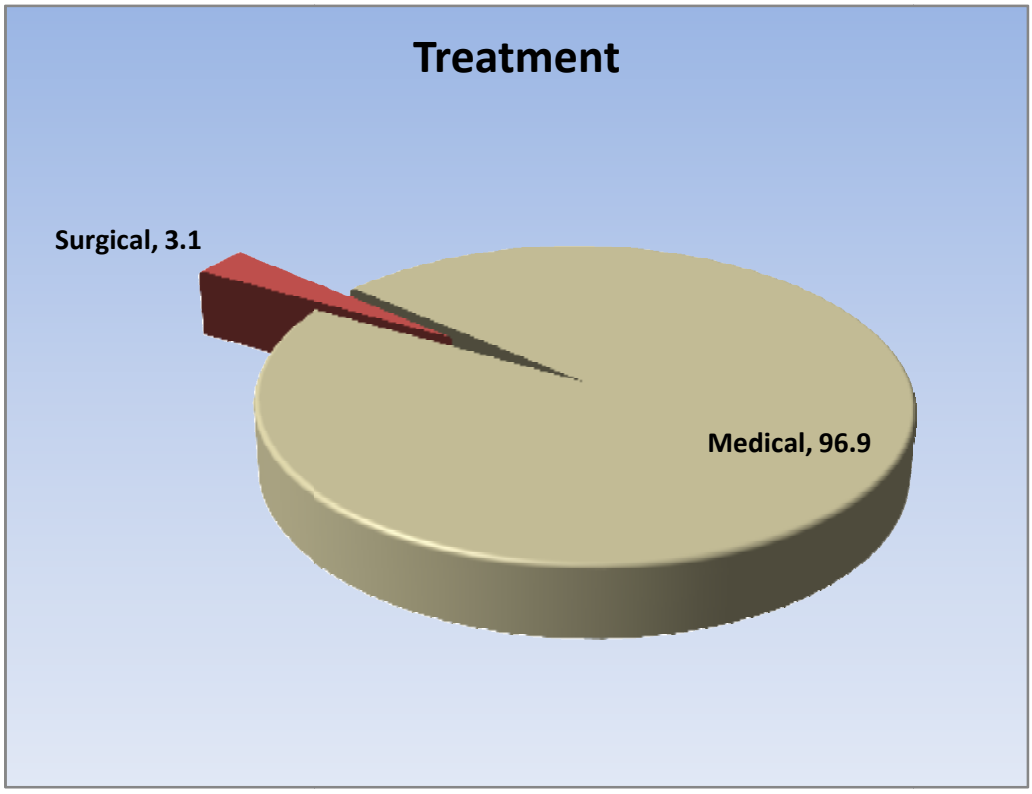
ETIOLOGICAL PATTERNS:

ETIOLOGY	PERCENTAGE
Inflammatory	39.79%
Ischaemic	18.36%
Idiopathic	28.06%
Infectious	2.04%
Vascular	7.14%
Neoplastic	2.55%
Others	2.04%



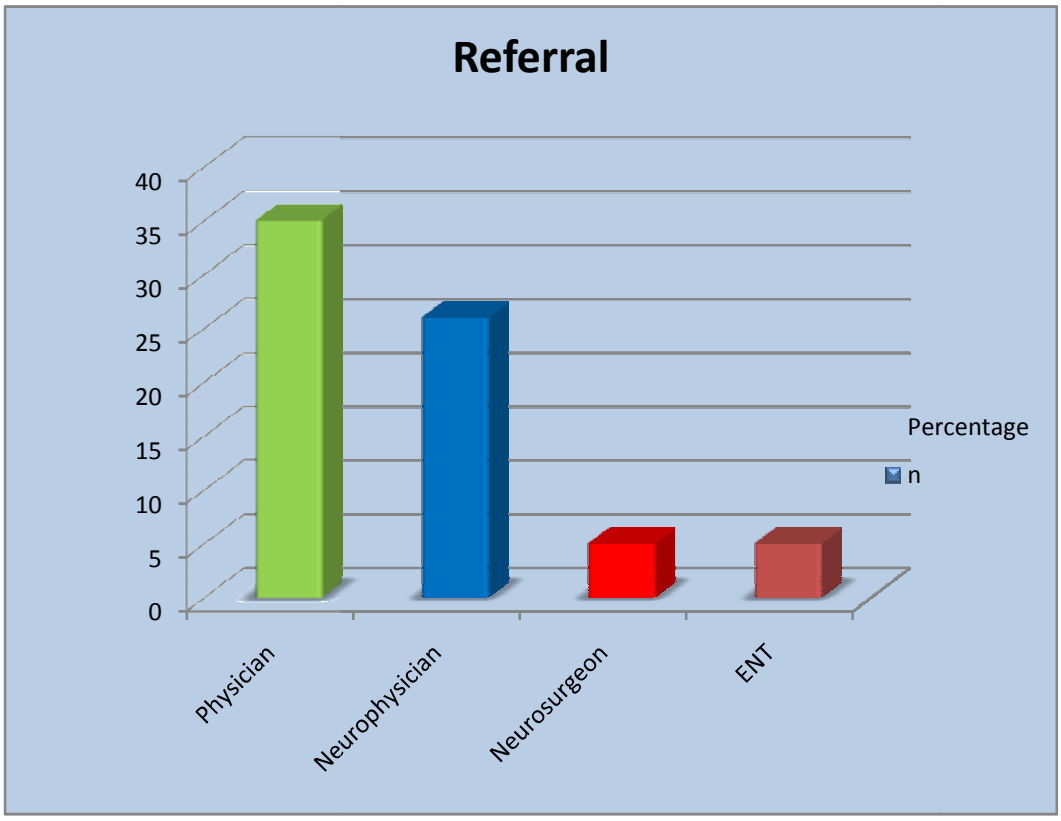
TREATMENT

Treatment	Percentage
Medical	96.9 %
Surgical	3.1 %



REFERRAL

Referral	N	Percentage
Physician	35	17.9 %
Neuro physician	26	13.3 %
Neuro surgeon	5	2.6 %
Others	125	63.8 %
ENT	5	2.6 %



DISCUSSION

Ocular motor cranial nerve palsies can occur due to lesions anywhere along their path between the nuclei and the extraocular muscles within the orbit. The largest report from the Mayo clinic, which included 4278 patients, identified sixth nerve palsy and undetermined cause as having the highest prevalence.

In our study of 196 patients of ocular motor nerve palsies , the most common one was the sixth cranial nerve palsy (42.3%), followed by the third nerve (38.8%), the fourth nerve (8.7%), combined nerve palsies(7.2%). Similar distribution pattern was found in the study by Sitaula et al, where the sixth cranial nerve was most frequently affected (53.85%), followed by third cranial nerve(24.18%). There were 10.99% of fourth cranial nerve palsy while 10.99% had combined cranial nerve palsies[35].

Menon et al (1984) reported similar distribution pattern in his study. The incidence of sixth cranial nerve palsy (44.6%), followed by third cranial nerve (32%), fourth cranial nerve (6.1%) and combined cranial nerve palsy(17.3%).

Age distribution analysis in our study revealed that 75% of all the cases were between 21 to 60 years. 5% cases were below 20 years. The mean age was 46.94 years. In contrast, in a study done by Tiffin et al

(1996), the mean age was around 62 years. The decrease in mean age among all the ocular motor nerve palsies was due to a larger number of younger population in our study.

Among the 12 cases with bilateral involvement, 10 cases were of sixth cranial nerve palsy. There was one case of bilateral combined cranial nerves palsy, which was due to sphenoclival malignancy. Remaining one case was bilateral fourth nerve palsy with undetermined cause.

This result was comparable to the study done by Menon et al (1984) in which there was no case of bilateral fourth nerve palsy but 9 cases had bilateral sixth nerve palsy. Similar findings were noticed by Tiffin et al in which there were 12 bilateral cases. Majority of them were of sixth cranial nerve palsy and one had fourth nerve involvement.

In our study, the etiology was undetermined in 28.06% of cases, whereas vascular causes attributed to 7.14%. Infections and other causes accounted for 4.08%.

	Menon et al	Sitaula et al	Our study
Vascular	7.1%	26.37%	7.14%
Neoplasm	12.2%	9.89%	2.55%
Undetermined	30.50%	31.86%	28.06%
Infections& others	9.02%	18.68%	4.08%

Most of the cases of third nerve palsy in our study were of inflammatory origin. 23.6% of cases had some degree of pupillary involvement. Cause was not identified in 40% cases of sixth cranial nerve palsy[34].

Combined ocular nerve palsies were mostly due to serious pathology and demanded more detailed workup. In our study, 62.5% cases were due to inflammatory cause, 18.75% were due to tumours, 6.25% were due to vascular cause and 6.25% were due to infection. Rush and Younge (1981) reported 32% of cases with tumours, 6.5% with vascular cause, 8.6% as undetermined and 28% with other causes. Sitaula et al reported 40% were due to tumours, 30% were vascular, 20% were undetermined and 10% were due to trauma.

Menon et al and Rama et al reported that incidence of aneurysmal nerve palsy was 1%. In one western report by Rush and Younge, the incidence of aneurysmal nerve palsy was as high as 7.1%. In our study, the incidence of aneurysmal nerve palsy was 0.51%.

In our study, 2% of cases had nerve palsy due to infections. Out of 4 cases, 2 cases were due to fungal sinusitis and 2 were due to tuberculous meningitis. Most common cause of nerve palsies in our study was due to inflammatory cause (39.79%). This includes cavernous sinus syndrome,

superior orbital fissure syndrome and orbital apex syndrome. 7 cases presented with orbital apex syndrome involving the optic nerve (3.6%).

All the patients in our study underwent neuroimaging. 55 patients (28.1) had CT done and 141 patients (71.9%) had MRI done. 104 patients (53.06%) had lesion in neuroimaging suggesting the cause for ocular motor cranial nerve palsy.

As regard to neoplasm causing ocular motor cranial nerve palsies, our study revealed undiagnosed tumour, primary or metastatic ; to be the causative lesion in 2.55% (5 out of 196). Bendszus found a high proportion of cases (60.4%) to be caused by tumours, tumour like lesions and metastases.

When the patients in our study were grouped according to their age, ischaemic factors had shown to cause the majority of ocular motor cranial nerve palsies starting from sixth decade .(i.e. above 50 years of age.)

Patel et al reported that if abducent nerve palsy is unaccompanied by any other neurologic features, it is advisable to defer neuroimaging while observing the patient monthly, but they also suggest that they are posed with the major drawback in not performing neuroimaging on initial presentation, in cases of isolated ocular motor nerve palsy in missing the diagnosis of an intracranial neoplasm.

In our study, 28 year old male presented to us with no history of vasculopathic risk factors showed acute unilateral isolated fourth nerve palsy. MRI brain showed diffuse thickening of tentorial petroclinoid ligament suggestive of hypertrophic pachymenigitis. After ruling out the secondary causes of hypertrophic pachymeningitis, he was diagnosed as idiopathic hypertrophic pachymeningitis. The patient was referred to neurophysician for further management.

Another interesting case is a 65 year old female patient with complaints of defective vision in both eyes, with no vasculopathic risk factors, presented with bilateral multiple ocular motor cranial nerve palsies. CT was done which showed sphenoclival malignancy with cavernous sinus extension and optic canal compromise with optic nerve compression. The patient was referred to neurosurgeon for further management.

Warwar et al[32] have reported a case where a 68 year old male presented with right abducent nerve palsy with vasculopathic risk factors. As he had risk factors for an ischaemic cause, neuroimaging was not done. He later developed oculomotor nerve palsy on the same side and while undergoing medical treatment, he developed hyperthermia and died. On autopsy, death was presumed to be due to pituitary apoplexy and compression of hypothalamus. This may indicate that neuroimaging should not be deferred at initial presentation. And if postponed, the patient must be

made aware of the condition and the necessity for immediate follow up when the condition worsens.

Bendszus et al[28] reported that Magnetic resonance imaging must be performed routinely in all patients of sudden isolated abducent nerve palsy, even for those with vasculopathic risk factors. They reported a suggestive lesion in 15% of vasculopathic patients. They report that this high proportion of severe and potentially treatable lesions justifies early MRI in patients with vasculopathic risk factors.

Neuroimaging alone can provide information about the etiology when history, clinical examination did not yield an etiological diagnosis.

The dilemma whether to image a patient or not in a case of ocular motor cranial nerve palsies lies largely with the decision of neuroophthalmologist and should be taken on individual basis depending on the condition of the patient.

LIMITATIONS

- For some patients MRI was not done because of cost factor, patients were not affordable and so CT was done.
- Few patients lost for follow up, (i.e) neuro imaging was ordered but did not come for follow up. So neuroimaging findings were missed. Those patients were excluded from the study.
- Follow up after treatment was not included in the study.

RESULTS

1. The mean age is 46.94 (15.87) years and the range is 1-80 years.
2. Males are most frequently affected than females. Males 103 (52.5%), females 93 (47.5%).
3. Most of the patients presented with complaints of double vision (66.3%) followed by drooping of lids (21.4%), defective vision (7.1%).
4. Mostly presented within one month duration (91.3%).
5. Cranial nerve palsies were mostly unilateral (93.9%).
6. 42.4% patients were associated with systemic illness like diabetes or hypertension.
7. 23.6% patients had some degree of pupillary involvement either Relative afferent pupillary defect or dilated and fixed pupil.
8. In 4.8% of patients, optic disc was abnormal, either edematous or hyperemic.
9. Sixth nerve palsy was the commonest (42.3%), followed by third nerve palsy (38.8%), fourth nerve palsy (8.7%).
10. Multiple cranial nerve palsy in 7 patients.(3.6%).
11. Orbital apex syndrome with optic nerve involvement in 7 patients (3.6%).

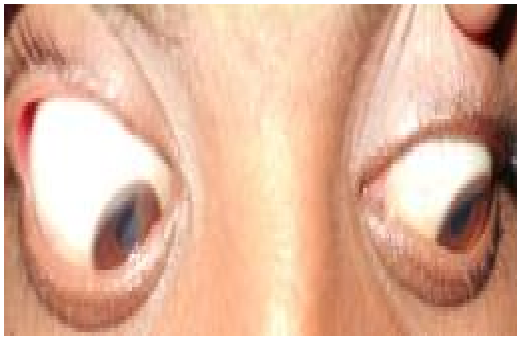
12. CT was done in 55 patients (28.1%) and MRI was done in 141 patients (71.9%).
13. The most common cause for cranial nerve palsies was inflammatory (39.79%) followed by idiopathic (28.06%), ischaemic (18.36%), vascular (7.14%), neoplastic (2.55%), infections (2.04%).
14. Most of the patients were managed medically (96.9%) followed by surgical treatment in 6 cases.(3.1%).

CONCLUSION

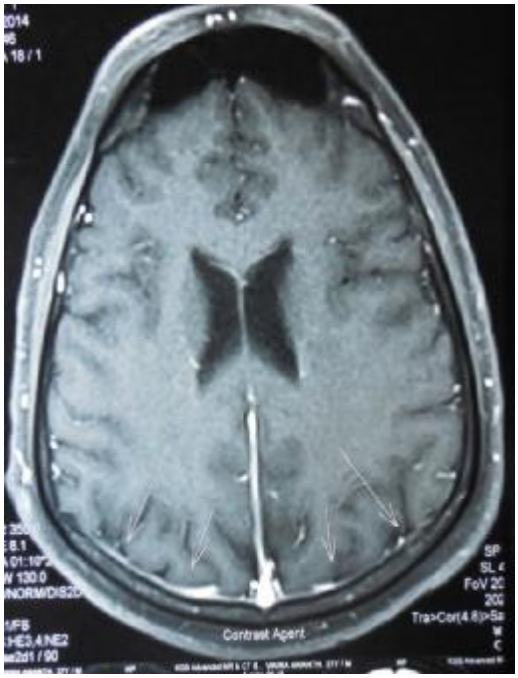
On the basis of our study, patients over 50 years of age, with vasculopathic risk factors, can be treated conservatively; but however these patients, in our opinion required to be monitored weekly and based on the recovery, the next decision can be taken. Worsening, non improvement for a period of 3 months or greater and progressive involvement of other cranial nerves need urgent neuroimaging. Also, in patients more than 50 years of age, isolated cranial nerve palsy in the absence of vasculopathic risk factors requires neuroimaging. In patients below 50 years presenting with non traumatic acute isolated nerve palsy or multiple cranial nerve palsies, we believe neuroimaging on initial presentation.

CASE ILLUSTRATIONS

CASE 1

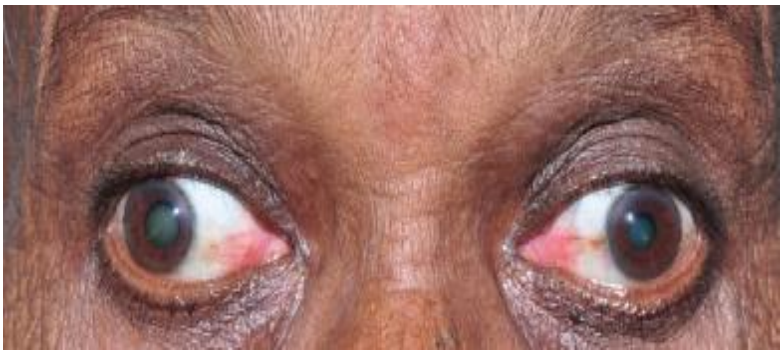


A 28 year old male with right fourth cranial nerve palsy

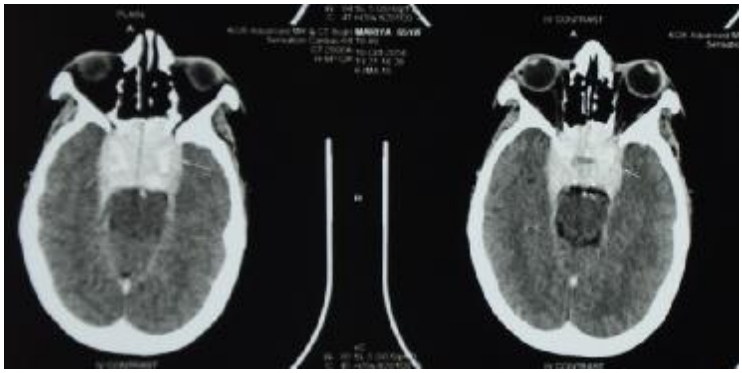


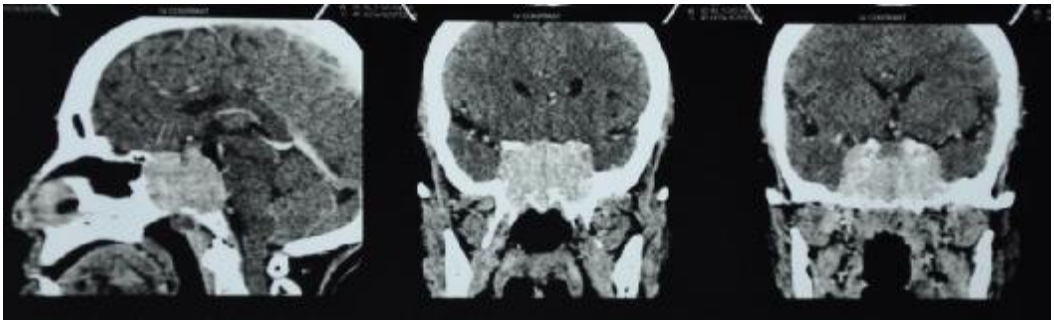
MRI with contrast showed diffuse thickening of tentorial petroclinoid ligament suggestive of hypertrophic pachymeningitis.

CASE 2



A 65 year old female with multiple cranial nerve palsy in both eyes

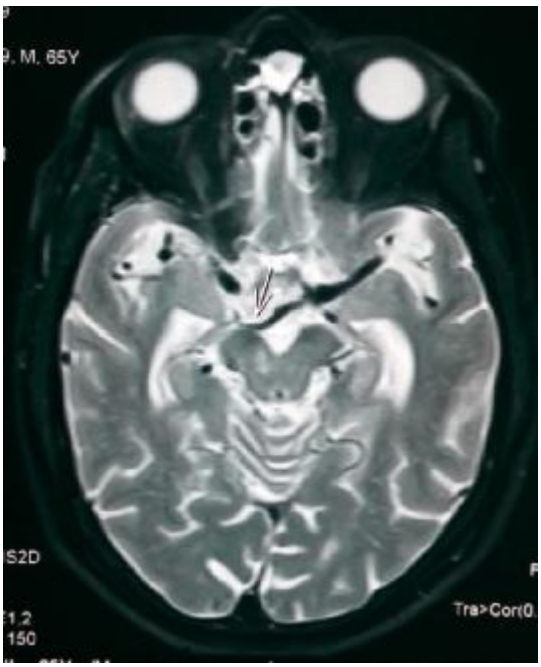


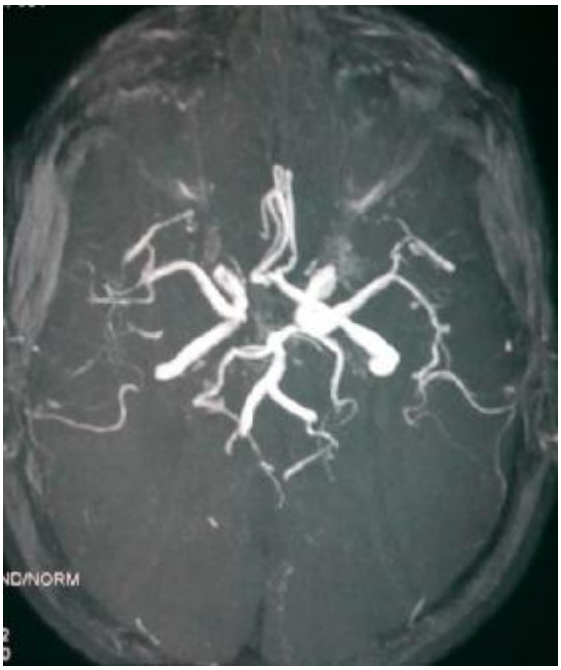


CT brain showing sphenoclival malignancy with cavernous sinus extension and optic nerve compromise with optic nerve compression

CASE 3

A 55 year old male with right oculomotor nerve palsy

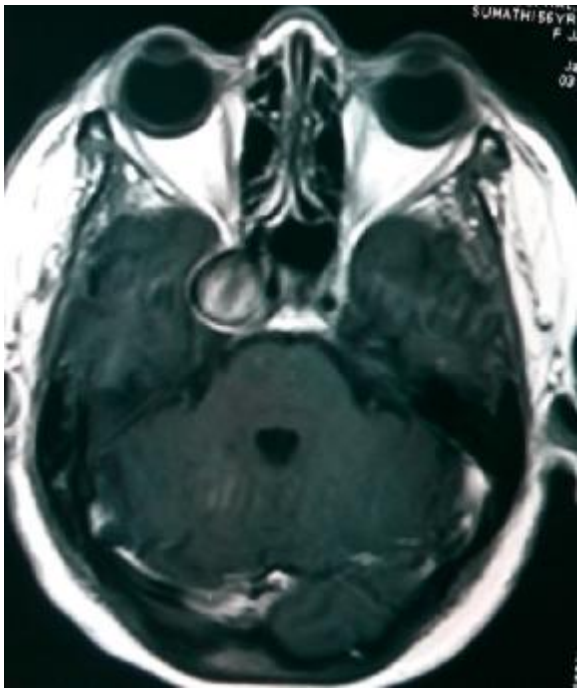




Ectatic P1 segment of right PCA compressing the cisternal and crural surface of right side 3rd cranial nerve.

CASE 4

A 44 year old female with right internal carotid artery aneurysm - cause for multiple cranial nerve palsy



MRI AND MRA (CONTRAST) showing intra cranial aneurysm in cavernous segment of right internal carotid artery

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PROFORMA

Case no.

Name

Age / Sex

MR No.

Address

Phone No.

	Chief complaints	Duration
Double vision	☐	☐
Defective vision	☐	☐
Eyelid drooping	☐	☐
Difficulty in eye movements	☐	☐
Headache	☐	☐

1-present

2 – Absent

1-<1month

2 - 1 Month- 1 year

3 - > 1 year

Diabetes

Hypertension

Ocular Examination

	OD	OS
BCVA	☐	☐

1 –6/6 to 6 /60

2 - 5/60 to 1/60

3 -< 1/60

Lids ☐ ☐

1 - Normal

2 - Ptosis

3 - Proptosis

4 – Lagophthalmos

Corneal reflex ☐ ☐

1 - Central

2 - Deviated

Pupil ☐ ☐

1 – Normal

2 - RAPD

3 – Dilated &fixed

4 – Sluggish

5 – Others

Extra Ocular Movements ☐ ☐

1- Full

2 – Abduction limitation

3 – Adduction limitation

4 –elevation limitation

5-depression limitation

6-intorsion limitation

7-multiple movements restriction

Corneal sensation

1 – Present

2 – Absent

Fundus Examination

Disc

1 – Normal

2 – Edematous

3 – Hyperemic

Macula

1 – Normal

2 – Abnormal

Colour Vision

Central fields

Hess charting

Diplopia charting

NEUROLOGICAL EXAMINATION

Higher functions

1 – Normal

2 – Abnormal

Cranial nerves

II

III ☐ ☐

IV ☐ ☐

V ☐ ☐

VI ☐ ☐

1 – Normal

2 – Affected

Investigations

BP

Complete blood count

ESR

Blood sugar

HbA1c

Diagnosis OD OS

☐ ☐

1-III Nerve palsy

A1-complete A2-partial

B1-Pupil involving B2-Pupil sparing

2-IV Nerve palsy

3-VI Nerve palsy

4- associated V nerve involvement

5-associated VII nerve involvement

6-normal

7 –others

Neuroimaging details

CT Brain ☐

MRI brain ☐

MRA brain ☐

Nature of lesion ☐

1-idiopathic

2-infectious

3-inflammatory

4-ischaemic

5-vascular

6-neoplastic

7-others

Site of lesion ☐

1-nuclear-fasicular

2-subarachnoid space

3-cavernous sinus

4-superior orbital fissure

5-orbital apex

6-others

Treatment ☐

1-medical

2-surgical

3-radiotherapy

4-all

Referral 

1-physician

2-neurophysician

3-neurosurgeon

4-radiologist

5-oncologist

6-others

ABBREVIATIONS

CT	-	Computed Tomography
MRI	-	Magnetic Resonance Imaging
PPRF	-	Parapontine Reticular Formation
CSF	-	Cerebrospinal Fluid
PCA	-	Posterior Communicating Artery
RAPD	-	Relative Afferent Pupillary Defect
ANA	-	Antinuclear Antibody
CCF	-	Carotico Cavernous Fistula
CVT	-	Cerebral Venous Thrombosis
BA	-	Basilar Artery
ICA	-	Internal Carotid Artery
LR	-	Lateral Rectus
MCA	-	Middle Cerebral Artery
ON	-	Optic Nerve
SOF	-	Superior Orbital Fissure
UBO	-	Unidentified Bright Object

KEY TO EXCEL SHEET

DM	-	DIABETES MELLITUS
HT	-	HYPERTENSION
RE	-	RIGHT EYE
LE	-	LEFT EYE
EOM	-	EXTRAOCULAR MOVEMENTS
LR	-	LATERAL RECTUS
OMN	-	OCULOMOTOR NERVE
SO	-	SUPERIOR OBLIQUE
IO	-	INFERIOR OBLIQUE
MRI	-	MAGNETIC RESONANCE IMAGING
CT	-	COMPUTED TOMOGRAPHY

ARAVIND MEDICAL RESEARCH FOUNDATION
Institutional Ethics Committee
(Registration No.ECR/182/Inst/TN/2013 dated 20.04.2013)

12th February 2015

To

Dr.S.Kanimozhi
MS Resident
Aravind Eye Hospital
Madurai

Dear Dr.Kanimozhi,

Thesis Title: Diagnostic Yield of Neuroimaging In Ocular Motor Cranial Nerve Palsies

IRB Code: IRB201400180

Thank you for submitting your thesis and seeking the approval from the ethics committee. The documents provided by you for consideration which include the thesis protocol and informed consent forms were reviewed for the research methodology and scientific content. The Ethical committee did not find any correction and has recommended the thesis to go ahead in the present form.

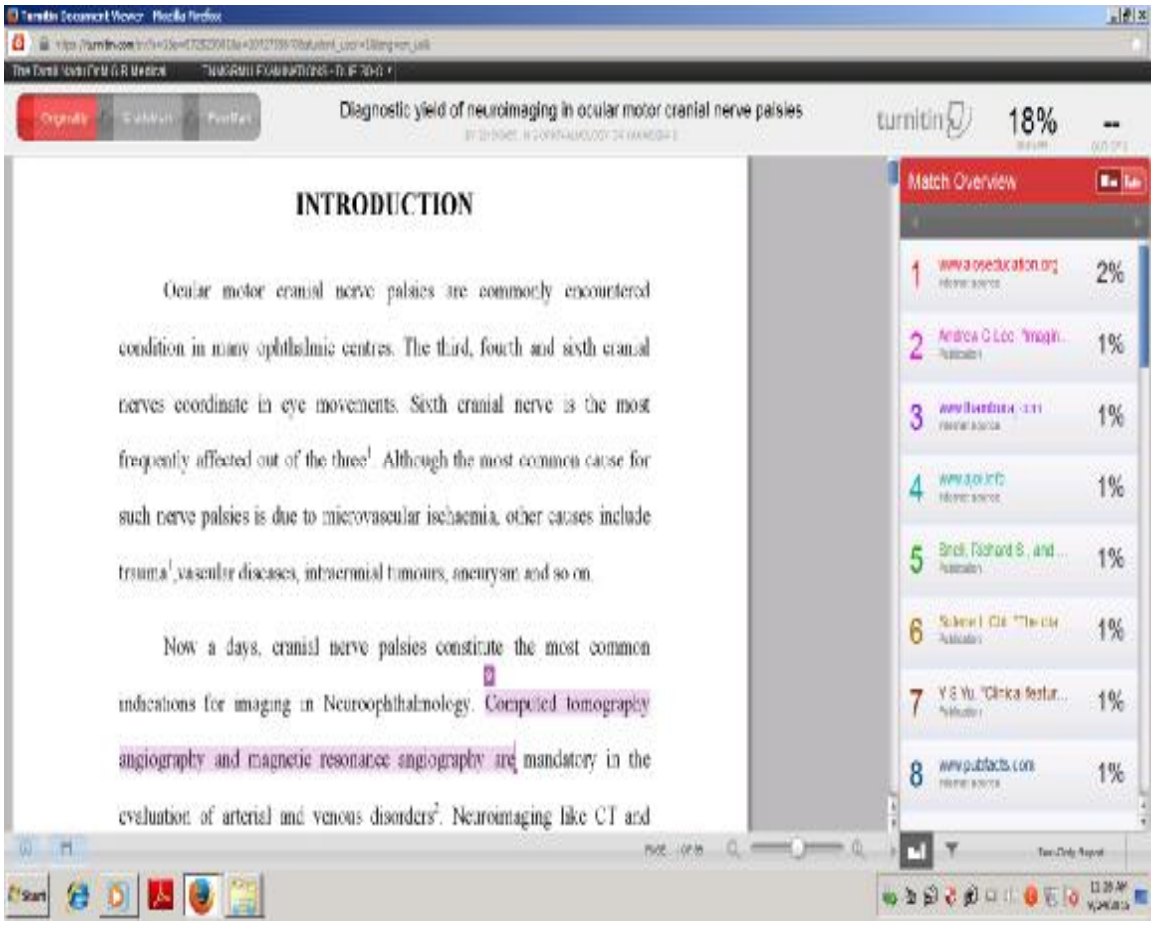
Thanking you

Yours Sincerely,

S. Lalitha.

Dr.Lalitha Prajna
Member Secretary
Institutional Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
ARAVIND MEDICAL RESEARCH FOUNDATION
No.1, Anna Nagar, Madurai-625 020


Diagnostic yield of neuroimaging in ocular motor cranial nerve palsies
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INTRODUCTION
Ocular motor cranial nerve palsies are commonly encountered condition in many ophthalmic centres. The third, fourth and sixth cranial nerves coordinate in eye movements. Sixth cranial nerve is the most frequently affected out of the three[1]. Although the most common cause for such nerve palsies is due to microvascular ischaemia, other causes include trauma[1], vascular diseases, intracranial tumours, aneurysm and so on.
Now a days, cranial nerve palsies constitute the most common indications for imaging in Neuroophthalmology. Computed tomography angiography and magnetic resonance angiography are mandatory in the evaluation of arterial and venous disorders[2]. Neuroimaging like CT and
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INTRODUCTION

MASER CHART

sno	mrno	name	age	gender	laterality	complaints	comp_duration	asso_h_o	sys_illness	va_re	va_le	lids	pupil_be	eom_re	eom_le	fundus	color_vision	central_fields	hess_charting1	cranial_nerves	other_cn	neuroimaging	nature_lesion	site_lesion	Diagnosis	treatment	referral
1	3856619	MEENAKSHI	31	F	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	3	4	SOF SYND	1	6
2	3838270	DURGADEVI	29	F	1	Def vn	2			3	1		LE 2	1	7	3	2	1	MULTIPLE CN	3,4,6	2	MRI/MR V	3	5	ORBITAL APEX	1	6
3	3858335	LAKSHMI	63	F	1	double vision	1		DM	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI	4	6	ISCHAEMIC	1	1
4	3814460	THANGAPANDIAMMAL	39	F	1	double vision	1		DM,Ca breast	1	1	RE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI&CT	4	6	ISCHAEMIC	1	1
5	3858219	ASHOKBABU	38	M	1	double vision	3			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	1
6	3857212	MEERAMAIDEEN	45	M	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	5		INFARCT	1	2
7	3852953	KATHUNBEGUM	51	F	1	Drooping	1	blocked nose		1	1	RE PTOSIS	RE 3	3,4,5	1	1	1	1	OMN PALSY	3©	1	CT	2	6	FUNGAL SINUSITIS	1	ENT
8	3860077	RAVIKUMAR	38	M	1	double vision	1		DM	1	1	LE PTOSIS	LE3	1	7	1	1	1	MULTIPLE CN	3,4,6	1	MRI/MR V	3	4	SOF SYND	1	2
9	3860397	DHANALAKSMI	51	F	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
10	3861041	RAJA	60	M	1	double vision	1		DM,HT	1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	4	6	ISCHAEMIC	1	1
11	3680142	SARAVANASTALIN	27	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	3	4	SOF SYND	1	1
12	3615836	BIMNA R GIRISH	11	F	1	Drooping	3			1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	4	SOF SYND	1	2
13	3674826	SIVAKUMAR	42	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	3	4	SOF SYND	1	6
14	3861193	PONRAMAN	43	M	1	Drooping	1			1	1	RE PTOSIS	1	4	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6
15	3773797	GNANAPANDIAMMAL	40	F	1	Drooping	1			1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	4	SOF SYND	1	6
16	3828510	VELUSAMY	75	M	1	double vision	1			2	2		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
17	3863706	MURUGAN	41	M	1	double vision	1		HT	1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
18	3850102	SANKARANARAYANAN	74	M	1	Drooping	1		DM	1	1	RE PTOSIS	RE 4	7	1	1	1	1	MULTIPLE CN	3,4,5,6	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
19	3826062	MARIAMMAL	39	F	1	double vision	1			2	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
20	3866809	RAJA	45	M	1	Drooping	1			1	1	RE PTOSIS	RE 3	3,4,5	1	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	4	SOF SYND	1	6
21	3867926	SELVAMANI	67	F	1	double vision	1	headache	DM,HT	1	1	RE PTOSIS	1	3,4	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	5	6	INFARCT	1	2
22	3873286	MUTHAMMAL	60	F	1	Drooping	1	headache		1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	CT	1	6	IDIOPATHIC	1	1
23	3874116	RAJESWARI	63	F	1	double vision	1		HT	1	1		1	1	1	1	1	1	IO PALSY	3(P)	1	MRI&CT	2	6	ISCHAEMIC	1	6
24	3874507	VAIRAANANTH	27	M	1	double vision	1	headache		1	1		1	6	1	1	1	1	SO PALSY	4	1	MRI/MR V	3	6	PACHYMENINGITIS	1	2
25	3875706	SENTHILKUMAR	46	M	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
26	3875854	PERIYAKARUPPAN	60	M	2	double vision	2			1	1		1	2	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
27	3880760	KOKILADEVI	29	F	1	double vision	1			1	1		1	1	6	1	1	1	SO PALSY	4	1	CT	1	6	IDIOPATHIC	1	6

28	3880251	RAMADEVI	34	F	1	Drooping	1	headache		1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	MRI/MRV	3	5	ORBITAL APEX	1	6
29	3875799	DEVARAJ	60	M	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
30	3851494	PALANIAPPAN	50	M	1	double vision	1		HT	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI&CT	2	6	ISCHAEMIC	1	6
31	1498241	POTHURA	20	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	1	6	IDIOPATHIC	1	6
32	3925901	KUNJUMAL OMNAKUTTAN	54	F	1	double vision	1		DM,HT	1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	3	6	ABDUCENT NEURITIS	1	6
33	3924318	RAJ	51	M	1	double vision	1			1	1		1	1	3	1	1	1	MR PALSY	3(P)	9,10,11	MRI/MRV	3		BASAL CRANIAL NEURITIS	1	2
34	3923093	SWETHA	15	F	2	double vision	1	headache		1	1		1	2	2	23	1	1	LR PALSY	6	1	CT	2		TB MENINGITIS	1	2
35	3922453	SIVALINGAM	62	M	1	Drooping	2	CVA	DM	1	1	LE PTOSIS	4	1	7	1	1	1	MULTIPLE CN	3,4,6	5	CT	5	3	CCF	1	3
36	3921228	THIYAGARAJAN	54	M	1	Deviation	1		DM,HT	2	1		1	3	1	1	1	1	OMN PALSY	3(P)	1	CT	1	6	ISCHAEMIC	1	1
37	3894195	SEDHUMANICKAM	45	F	1	Drooping	1	headache		1	3	LE PTOSIS	LE3	1	7	4			MULTIPLE CN	3,4,6	5	CT	3	5	ORBITAL APEX	1	6
38	3847562	NATARAJAN	59	M	1	Drooping	1			1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	3		3 NERVE NEURITIS	1	6
39	3908237	SEKAR	40	M	1	double vision	2	headache		1	1		1	1	2	1	1	1	LR PALSY	3,4,6	5,9,10	MRI/MRV	2	3	CAVERNOUS SINUS	1	ENT
40	3907722	KUZHALVAIMOZHI	42	F	1	double vision	1			1	1		ADIE PUPIL	1	6	1	1	1	SO PALSY	4	1	CT	1		IDIOPATHIC	1	6
41	3907622	SOUKATH ALI	42	M	1	double vision	1	headache		1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	1		IDIOPATHIC	1	6
42	3907614	VINU	26	M	1	double vision	3			1	1		1	5	1	1	1	1	IR PALSY	3(P)	1	MRI	1		IDIOPATHIC	1	6
43	3747786	BIRUNTHA	71	F	1	Drooping	1		DM,HT	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	3	3	PACHYMENINGITIS	1	6
44	3628103	MALARMATHI	40	F	1	double vision	1			1	1	RE PTOSIS	RE4	7	1	1	1	1	MULTIPLE CN	3(P),6	1	MRI/MRV	3	4	SOF SYND	1	6
45	3877884	PANJU	30	F	2	double vision	1	headache		1	1		1	2	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
46	3880954	NAGOOR THEVAR	80	M	1	double vision	2			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MRV	1	6	IDIOPATHIC	1	6
47	3943981	MAHALINGAM	60	M	1	double vision	1		HT	1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	ISCHAEMIC	1	6
48	3928813	ABBAS KANI	65	M	1	double vision	1		DM,HT	1	1	RE PTOSIS	RE4	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	5		ECTATIC P1 SEG ® PCA	1	2
49	3947879	AMOSE	63	M	1	double vision	1		DM,HT	1	1	RE PTOSIS	RE4	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	1	6	ISCHAEMIC	1	1
50	3947229	SUBBULAKSMI	28	F	1	double vision	1	fever		1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MRV	1	6	IDIOPATHIC	1	6
51	3311682	ARUMUGAM	70	M	1	double vision	1		DM	3	1	RE PTOSIS	BE4	7	1				MULTIPLE CN	3,4,6	5	MRI/MRV	2	5	FUNGAL SINUSITIS	1	ENT
52	3872426	BALASARASWATHI	45	F	1	double vision	1	facial pain		1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	3	4	SOF SYND	1	6
53	3832801	MUTHUMEENA	24	F	1	Drooping	1	headache		1	1	LE PTOSIS	LE4	1	7	1	1	1	MULTIPLE CN	3,4,6	1	CT	3	3	CAVERNOUS SINUS	1	6
54	3872448	KUMUTHA	45	F	1	Drooping	1	eye pain	DM	1	1	LE PTOSIS	LE4	1	7	1	1	1	MULTIPLE CN	3,4,6	5	MRI/MRV	3	4	SOF SYND	1	6
55	3933952	SELVI	32	F	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	3	6	ABDUCENT NEURITIS	1	6
56	3944314	CHINNATHAI	45	F	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MRV	3	6	LR MYOSITIS	1	6
57	3873671	MUTHAMMAL	64	F	1	Drooping	1			1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	CT	1	6	IDIOPATHIC	1	6

58	3878041	SUBBARAO	65	M	1	double vision	1		DM	1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	ISCHAEMIC	1	6
59	3877635	ARUMUGAM	61	M	1	double vision	1		DM	1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
60	1486202	CHELLAMMAL	55	F	1	Def vn	1			1	1		1	1	6	1	1	1	SO PALSY	4	1	MRI/MR V	1	6	IDIOPATHIC	1	6
61	1485202	KRISHNAMOORTHY	63	M	1	Drooping	1		DM	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3©	1	MRI/MR V	1	6	ISCHAEMIC	1	6
62	1483837	CHINNATHAMBI	45	M	1	Drooping	1			1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	4	SOF SYND	1	6
63	1473325	RAVANAMMA	65	F	1	Drooping	1			1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3©	1	MRI/MR V	5		ICA ANEURYSM	1	3
64	1486844	JEYA	55	F	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
65	3886381	VEERAMMAL	70	F	1	double vision	1	headache		1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3©	1	MRI&CT	3	3	CAVERNOUS SINUS	1	6
66	3898789	PRIYA	22	F	1	double vision	1	headache		1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	6	PACHYMENINGITIS	1	6
67	3900902	RAJATHY	70	F	1	Drooping	1	headache		1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
68	3901038	DHANALAKSHMI	20	F	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
69	3901662	VELUSAMY	65	M	1	Drooping	1			1	1	RE PTOSIS	RE 3	3,4,5	1	1	1	1	OMN PALSY	3©	1	CT	1	6	CHRONIC PALSY	1	6
70	3902580	ANIS HAJARA	37	F	1	double vision	1			1	1		1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	IDIOPATHIC	1	6
71	3903021	PRASANNA	51	F	1	Drooping	2		HT	1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3(P)	1	CT	3	4	SOF SYND	1	6
72	3804335	JEYALAKSHMI	25	F	2	double vision	1	fever	TB	1	1		1	2	2	1	1	1	LR PALSY	6	7,8	MRI/MR V	2		LEPTOMENINGITIS	1	6
73	3892652	ARUNKUMAR	15	M	1	double vision	1	headache		1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6
74	3911603	VEERASELVI	29	F	1	double vision	1	headache		1	1		RE3	5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	IDIOPATHIC	1	6
75	3948322	GANDHIMATHI	55	F	1	double vision	1			1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3(P),4,6	5	MRI/MR V	7	6	SUPRASELLAR CYST	1	3
76	3950625	SARASWATHY	48	F	1	double vision	1		DM,HT	2	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	ISCHAEMIC	1	6
77	3950698	SANKARANNAMPOOTHIRI	33	M	1	Drooping	1			1	1	RE PTOSIS	1	4	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	IDIOPATHIC	1	6
78	3910266	RAJESWARI	55	F	1	Drooping	2			1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	CT	3	4	SOF SYND	1	6
79	3885707	MUTHUSAMY	75	M	1	double vision	1			1	1			1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	IDIOPATHIC	1	6
80	3885834	SOUNDARARAJAN	61	M	1	Drooping	1			1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI&CT	6	6	SKULL BASE MENINGIOMA	2	3
81	3953927	PAKKIRISAMY	62	M	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
82	3928894	MEENAKSHIDEVI	51	F	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
83	3958447	AVINASH	7	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
84	3957917	ALEYAMMAK.MATHEW	55	F	1	double vision	1		THYROID	1	1		1	1	5	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	IDIOPATHIC	1	2
85	3828739	LAKSHMINARAYANAN	63	M	1	double vision	1	headache	HT,DM	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
86	3929016	DHIVYA	16	F	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
87	3894667	YESURAJA	31	M	1	double vision	1		HT	1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6

88	3952220	SUGUMARPANDI	51	M	1	double vision	1	headache		1	1		1	1	6	1	1	1	SO PALSY	4	1	MRI/MR V	3	6	SUBACUTE MENINGITIS	1	2
89	3953162	MUHANMMADAFKAR	1	M	1	squinting	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	3	6	PETROCLINOIDLIGAMENT	1	2
90	3956062	DURAIPANDI	43	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
91	3956038	RAMALINGAM	49	M	1	double vision	1		DM	1	1		1	1	6	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
92	3833433	SEENIMUDALI	62	M	1	Pain	1	headache	DM	1	1		1	4	1	2	2		OMN PALSY	3(P)	2	MRI/MR V	1	6	ISCHAEMIC	1	2
93	3885867	ATHISAYAM	42	M	1	double vision	1			1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	6	3 NERVE NEURITIS	1	2
94	3772984	VENKATESWARAN	29	M	2	double vision	1			1	1		1	2	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
95	3791576	VIJAYAKUMAR	37	M	1	Drooping	1			1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	4	SOF SYND	1	6
96	3919972	INDRA	53	F	1	Def vn	1			1	1		1	1	5	1	1	1	OMN PALSY	3(P)	1	CT	1	6	IDIOPATHIC	1	6
97	3930198	SELVAM	42	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
98	3534572	RAMALINGAM	60	M	1	Def vn	2		DM,HT	1	1		1	6	1	1	1	1	SO PALSY	4	1	MRI/MR V	5	6	ACUTE INFARCT PCA	1	6
99	3882844	DEVARAJAN	50	M	1	Def vn	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
100	3962987	SYED MOSIN	18	F	1	double vision	1			1	1		RE3	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
101	3803267	MURUGAIAH	40	M	1	double vision	1	headache	DM	1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	ISCHAEMIC	1	6
102	3804822	VANAJA	58	F	1	Def vn	1		DM,HT	1	3	LE PTOSIS	LE3	1	345	1	2	2	OMN PALSY	3©	1	MRI/MR V	3	5	ORBITAL APEX	1	6
103	3959000	AJMALKHAN	31	M	1	double vision	1	headache		1	1		LE3	1	6	1	1	1	SO PALSY	4	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
104	3960159	LATHA	40	F	1	double vision	1	headache		1	1		1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	CT	3	4	SOF SYND	1	6
105	3961617	SUMATHI	56	F	1	double vision	1		HT	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	5	6	ICA ANEURYSM	1	2
106	3961914	PILLAIYAR	65	M	1	double vision	1			1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	6	3 NERVE NEURITIS	1	6
107	3966776	VEERAPUTHIRAN	59	M	1	Deviation	2			1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
108	3966855	KRISHNAN	55	M	1	Drooping	1	headache		1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6
109	3969929	SAHUBAR SADIQ	49	M	1	double vision	1		DM	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
110	3970502	CHITRA	31	F	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
111	3970666	BABU	42	M	1	double vision	2			1	1		1	1	6	1	1	1	SO PALSY	4	1	MRI&CT	1	6	IDIOPATHIC	1	6
112	3942588	GNANA VENNILA	22	F	1	double vision	1	headache		1	1		1	6	1	23	1	1	SO PALSY	4	1	MRI/MR V	1	6	IDIOPATHIC	1	6
113	3963469	AMUTHA	45	F	1	double vision	1	headache		1	3	LE PTOSIS	LE3	1	345	1	2	2	OMN PALSY	3©	1	MRI/MR V	3	5	ORBITAL APEX	1	6
114	3963710	SUNDARA NARAYANAN	28	M	1	double vision	1			1	1		1	1	4	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
115	3964518	MANIMEKALAI	30	F	1	double vision	1			1	1		1	1	6	1	1	1	SO PALSY	4	1	MRI/MR V	7	6	UBO/MBO/ISCHAEMIA	1	2
116	3617895	AMSAVALLI	56	F	1	double vision	1			1	1		1	1	6	1	1	1	SO PALSY	4	1	MRI/MR V	1	6	IDIOPATHIC	1	6
117	3964537	NEELAMEGAM	58	M	1	double vision	1		Nasopharngeal ca	1	1		1	1	234	1	1	1	MULTIPLE CN	3,4,6	2,5,7	CT	6	34	TUMOUR EXTENSION	1	2

118	3966139	BANUMATHI	40	F	2	Def vn	1	headache		1	1		1	2	2	1	1	1	LR PALSY	6	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
119	3964111	INDIRA	52	F	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
120	3964246	SAMPOORANAM	65	F	1	Pain	1	headache		1	1	RE PTOSIS	1	2,3,4,5	1	2	1	1	MULTIPLE CN	2,3,4,6	1	CT	36	3	ON MENINGIOMA	1	2
121	3946710	NAGENDRAN	50	M	1	double vision	2		DM	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	CT	3	4	SOF SYND	1	6
122	3975471	HASHED HAMOOD	57	M	1	double vision	3		HT	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MRV	5	6	DOLICOECTASIA BA	1	6
123	2903009	RENUKADEVI	50	F	1	double vision	1	headache	DM,HT	1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	7	6	EARLYFRONTOTEMPORAL LOBAR	1	2
124	3974609	MARUTHU	63	M	1	Pain	1			1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
125	3975671	DHANAM	25	F	2	double vision	1	headache		1	1		1	2	2	1	1	1	LR PALSY	6	1	MRI&CT	1	6	IDIOPATHIC	1	6
126	3974562	DHANABALAN	31	M	1	double vision	1	headache		1	1		1	1	2	23	1	1	LR PALSY	6	1	MRI/MRV	5	6	CVT	1	2
127	3973432	BALAMURUGAN	28	M	1	Drooping	1			1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	5	6	MIDBRAIN INFARCT	1	2
128	3973172	SAMY DURAI	75	M	1	Drooping	1		DM	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
129	3972112	DURAISAMY	36	M	1	Drooping	1		HIV	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3©	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
130	3972009	DEVARANJITHAM	69	F	1	double vision	1		DM,HT	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	1	6	ISCHAEMIC	1	6
131	3971864	KANNAN	30	M	1	double vision	1		DM,HT	1	1		1	2	1	1	1	1	LR PALSY	6	5	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
132	3971713	MARISIVA	22	M	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
133	3971594	INDRANI	55	F	1	double vision	1	eye pain		1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	5	MRI/MRV	3	4	SOF SYND	1	6
134	3971067	PUSHPAM	42	F	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
135	3643802	AMBILI	44	F	1	double vision	2			1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
136	1515321	CHINRAJ	45	F	1	Drooping	1			1	1	LE PTOSIS	LE 3	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	3	6	3 NERVE NEURITIS	1	6
137	1519639	POOMARI	48	F	1	double vision	1			1	1		1	1	6	1	1	1	SO PALSY	4	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
138	1520277	MANICKAM	52	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
139	1497451	MARIYA	65	F	2	Def vn	1	headache		3	3		BE 3	7	7	1	2	2	MULTIPLE CN	3,4,6	2,5	CT	6	3	SPHENOCLIVAL MALIGNANCY	2	3
140	3515714	ASIYAMARIYAM	54	F	1	Drooping	1		DM,HT	1	1	LE PTOSIS	LE3	1	2345	1	1	1	MULTIPLE CN	3,4,6	1	MRI/MRV	3	4	SOF SYND	1	6
141	3977958	DURAIKUMAR	40	M	1	Drooping	1	headache		1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	1	6	IDIOPATHIC	1	6
142	3976351	NABEESA BEEVI	75	F	1	double vision	1	headache	HT	1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	5	3	CCF	1	2
143	3969409	JEYALAKSHMI	50	F	1	double vision	1		DM	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MRV	3	4	SOF SYND	1	6
144	3966832	BALACHANDER	31	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
145	3979500	MANIKANDAN	7	M	1	Def vn	1	headache		1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MRV	3	3	CAVERNOUS SINUS	1	6
146	3985389	SELVAM	29	M	1	Deviation	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
147	3984134	MARIMUTHU	66	M	1	double vision	1			1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MRV	1	6	ISCHAEMIC	1	6

148	3984076	LEELA	75	F	1	double vision	1		DM,HT	1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	ISCHAEMIC	1	6
149	3982964	KARTHICK	31	M	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	2	4	SOF SYND	1	6
150	3675623	RATHINAM	70	M	1	double vision	1	headache	HT	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V		3	SPHENOIDAL MUCOCELE	1	ENT
151	3983342	SAKTHIRAJA	29	M	1	double vision	1			1	1	LE PTOSIS	LE 3	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	5	1	MIDBRAIN INFARCT	1	2
152	3938511	BALASUBRAMANIAN	64	M	1	double vision	1		DM,HT	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	ISCHAEMIC	1	6
153	3941167	MURUGANANDHAM	47	M	1	Drooping	1		HT	1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6
154	3941934	ISMAIL KUNJU	71	M	1	double vision	1		HT	1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	5	6	MCA INFARCT	1	2
155	3984483	THAVAMANI	66	M	1	double vision	1		HT	1	1	LE PTOSIS	LE3	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	ISCHAEMIC	1	6
156	3986664	SIVA	5	M	1	Deviation	1	fever		1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
157	3729575	PETCHIAMMAL	58	F	1	double vision	1			1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3©	1	MRI/MR V	3	4	SOF SYND	1	6
158	3987874	RAMASAMY	47	M	1	double vision	1		DM,HT	1	1		1	1	6	1	1	1	SO PALSY	4	1	CT	1	6	ISCHAEMIC	1	6
159	3985711	PARVATHI	54	F	2	double vision	1		DM	1	1		1	2	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
160	3988455	DHARMAR	39	M	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
161	3984634	ANNALAKSHMI	45	F	1	Def vn	1			1	1		1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6
162	3988799	MUTHAIAH	60	M	1	Drooping	1		HT	1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	CT	1	6	ISCHAEMIC	1	6
163	3757439	LAKSHMI	43	F	1	Drooping	1			1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6
164	3837997	SUNDARAJAN	52	M	2	double vision	1		DM,HT	1	1		1	2	2	1	1	1	LR PALSY	6	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
165	3970992	BHARATHAN	60	M	1	double vision	1		DM,HT	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	ISCHAEMIC	1	6
166	3990617	KARUPPAYEE	60	F	1	Def vn	1		DM,HT	1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	ISCHAEMIC	1	6
167	3989383	NAVYA	21	F	2	double vision	1		TB	1	1		1	2	2	1	1	1	LR PALSY	6	1	MRI/MR V	2	6	TB MENINGITIS	1	2
168	3990448	RUBA HARI	36	F	1	Deviation	1		DM	1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	ISCHAEMIC	1	6
169	3990689	SUJATHA	52	F	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
170	3990342	MATHIIYLAGAN	57	M	1	double vision	1		DM	1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
171	3989874	MOOKAMMAL	48	F	1	double vision	1		DM	1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	ISCHAEMIC	1	6
172	2847748	MUTHUSAMY	60	M	1	Def vn	1		DM	3	1		RE3	2	1	2	2	1	LR PALSY	6	2	MRI/MR V	3	5	ORBITAL APEX	1	6
173	3992137	BALAMMAL	41	F	1	Drooping	1			1	1	RE PTOSIS	RE 3	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	IDIOPATHIC	1	6
174	3997110	MUTHU	45	M	1	Drooping	1			1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	5	6	PARIETAL INFARCT	1	2
175	3831638	ARUN	38	M	2	double vision	1			1	1		1	6	6	1	1	1	SO PALSY	4	1	MRI/MR V	1	6	IDIOPATHIC	1	6
176	3995013	JESINTHA RANI	40	F	1	double vision	1		CA breast	1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
177	3995350	CHINNAIAH	55	M	1	Def vn	1			2	1	RE PTOSIS	1	3,4,5	1	2	2	1	OMN PALSY	3(P)	2	CT	6	6	SINONASAL MALIGNANCY	1	ENT

178	3995279	SUTHA	36	F	1	double vision	1			1	1	LE PTOSIS	1	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	4	SOF SYND	1	6
179	4001659	SANGEEETHA	30	F	1	double vision	1			1	1		1	2	1	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	IDIOPATHIC	1	6
180	3991992	PALANIKUMAR	38	M	1	Drooping	1			1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	3	3	CAVERNOUS SINUS	1	6
181	3997173	RAJENDRAN	57	M	1	double vision	1		DM	1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI/MR V	1	6	ISCHAEMIC	1	6
182	3995955	KRISHNASAMY	60	M	1	double vision	1			1	1		1	1	6	1	1	1	SO PALSY	4	1	MRI/MR V	1	6	IDIOPATHIC	1	6
183	3744536	SIVARAJ	45	M	1	Drooping	1		DM	1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	1	6	ISCHAEMIC	1	6
184	3992904	SANTHANALAKSHMI	33	F	1	Drooping	1			1	1	LE PTOSIS	1	1	235	1	1	1	OMN &LR PALSY	3(P),6	1	CT	3	4	SOF SYND	1	6
185	3993344	BANUMATHI	60	F	1	double vision	1		HT	1	1		1	1	2	1	1	1	LR PALSY	6	1	MRI	1	6	ISCHAEMIC	1	6
186	3760216	MARIAMMAL	47	F	1	Def vn	1	fever		3	1		RE 3	2,3,4,5	1	2	2	1	MULTIPLE CN	3,4,6	2,5	CT	3	5	ORBITAL APEX	1	6
187	3992674	SELVI	40	F	1	double vision	1			1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	3	4	SOF SYND	1	6
188	3972795	JAYARAMAN	66	M	1	double vision	1		DM	1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	ISCHAEMIC	1	6
189	3980142	CHELLA PAPPA	58	F	1	double vision	1			1	1		1	6	1	1	1	1	SO PALSY	4	1	MRI/MR V	1	6	IDIOPATHIC	1	6
190	3653244	VASANTHA	60	F	1	double vision	1		HYPERLIPIDEMIA	1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
191	1536118	JEYA	51	F	1	Deviation	2			1	1		1	1	2	1	1	1	LR PALSY	6	1	CT	1	6	IDIOPATHIC	1	6
192	1535429	MOHAN	44	M	1	Drooping	1			1	1	RE PTOSIS	1	3,4,5	1	1	1	1	OMN PALSY	3©	1	CT	1	6	IDIOPATHIC	1	6
193	1520908	MUTHUPANDIAN	55	M	1	double vision	1			1	1	RE PTOSIS	RE3	3,4,5	1	1	1	1	OMN PALSY	3©	1	CT	1	6	IDIOPATHIC	1	6
194	4001519	KALIAMMAL	50	F	1	double vision	1		DM	1	1		1	2	1	1	1	1	LR PALSY	6	1	CT	3	3	CAVERNOUS SINUS	1	6
195	3997967	GUNASEKARAN	65	M	1	double vision	1			1	1		1	1	6	1	1	1	SO PALSY	4	1	CT	1	6	IDIOPATHIC	1	6
196	3790134	RAJAKUMARI	63	F	1	Drooping	1			1	1	LE PTOSIS	LE 3	1	345	1	1	1	OMN PALSY	3(P)	1	MRI/MR V	5	3	CAVERNOUS SINUS	1	2